

123456789







HD28  
.M414  
no. 1274-82  
c. 2

AN ANALYSIS OF THE DIMENSIONS OF  
PRODUCTIVITY OF THE U.S. AUTOMOBILE  
INDUSTRY AND SOME EXPLANATIONS

February 1982

1274-92



AN ANALYSIS OF THE DIMENSIONS OF  
PRODUCTIVITY OF THE U.S. AUTOMOBILE  
INDUSTRY AND SOME EXPLANATIONS

February 1982

1274-92

This research has been supported by the U.S. Department of Transportation  
Contract DTRS 5681-C-00021.





AN ANALYSIS OF THE DIMENSIONS OF  
PRODUCTIVITY OF THE U.S. AUTOMOBILE INDUSTRY  
AND SOME EXPLANATIONS

by

Zenon S. Zannetos\*

Themis A. Papageorgiou\*\*

Ming-Je Tang\*\*\*

William B. Lindsley\*\*\*

February 1982

\* Professor of Management and Principal Investigator, Sloan School of Management, M.I.T., 50 Memorial Drive, Cambridge, MA 02139, Phone (617) 253-7164.

\*\* Research Associate, Sloan School of Management, M.I.T.

\*\*\* Doctoral Candidate, Sloan School of Management, M.I.T.



TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION	1
II. DIMENSIONS OF PRODUCTIVITY	5
A. Theoretical Definition of Average and Marginal Productivity	5
B. Empirical Application of Average Productivity Equation	7
C. Empirical Application of Marginal Productivity Equation	15
III. DIMENSIONS OF VALUE ADDED	17
A. Theoretical Definitions	17
B. Empirical Application of Percentage Contribution Equation	20
C. Empirical Application of Changes in Percentage Contribution Equation	29
IV. PRODUCTIVITY MEASUREMENT: COMPARISON WITH MANAGERIAL PERFORMANCE INDICATORS	35
A. Managerial Performance Indicators	35
B. Time Series of Managerial Performance Indicators	36
C. Model Testing	47
1. Model 1	47
2. Model 2	49
3. Statistical Results	51
V. CONCLUSIONS	55
A. Competitive Labor Market	56
B. Non-Competitive Labor Market	57



## I. INTRODUCTION

We have extensively discussed various productivity measures in Working Paper SSM #1251-81 and Working Paper SSM #1234-82. We have deduced that only value added of output(s) over value of input(s) measures fulfill for the most part the criteria of homogeneity, robustness, validity, practicality and utilization.

As we have pointed out in Working Paper SSM#1234-82, our statistical tests using the automobile industry as our empirical domain showed that the time series of the value added over payroll and benefits measure of productivity generally exhibited superior performance. In a few cases that value added over payroll and benefits was not the best measure, it performed very closely to the best measure (value added over operating costs and depreciation or capital expenditure), according to our test.

However, there is a fundamental reason which dictates the eventual adoption of the value added over payroll and benefits measure as the most meaningful measure of productivity. The reason is that for our strategic approach to industry analysis a meaningful measure of productivity should not only describe the productivity of a firm absolutely but also relatively to its degree of vertical integration.

The time series of value added over operating costs and capital expenditures (or depreciation) adequately describe absolute productivity but are deficient in describing relative productivity because the denominator (operating costs) is dependent upon the varying degree of vertical integration from one particular firm to another. In our estimation this is a very important point because the changes in vertical integration over the years, implemented either by conscious strategic planning or enforced by external



economic/political influences greatly affects the relative measurement of productivity among firms and can even mislead the uninitiated analyst.

Since we have chosen the U.S. Automobile industry as our domain for the empirical application of our theoretical concepts, we present in Figure 1(a,b) the time series of value added over sales for General Motors and Ford as a proxy measure of vertical integration for these two firms. We observe that the degree of vertical integration for General Motors has declined significantly from 1963 and for Ford from 1960 onwards. That means that the ratio of the value of materials purchased from vendors over sales kept increasing. Complexity of operations and/or higher wages are the only plausible explanation for the decline of value added over sales.

Besides the conventional measure of vertical integration shown in Figure 1(a,b), we present in Figure 1(c,d) an alternative measure of vertical integration, namely value added to cost of goods sold over cost of goods sold. The value added over sales measure of vertical integration includes market power aberrations reflected in sales, which the latter measure avoids. We observe in Figure 1(c,d) that the degree of vertical integration for General Motors has declined significantly from 1961 and for Ford from 1960 onwards. Since both firms kept increasing their purchased materials from vendors, we may hypothesize that the industry experienced increased complexity of operations and/or higher wages.

It should be noted that both measures exhibit the same relative decline which further enhances our conclusion about the decline of vertical integration.





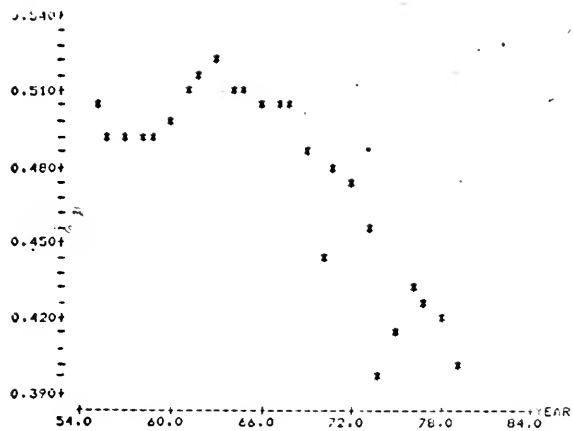


Figure 1(a):

Value Added over Sales  
(GM)

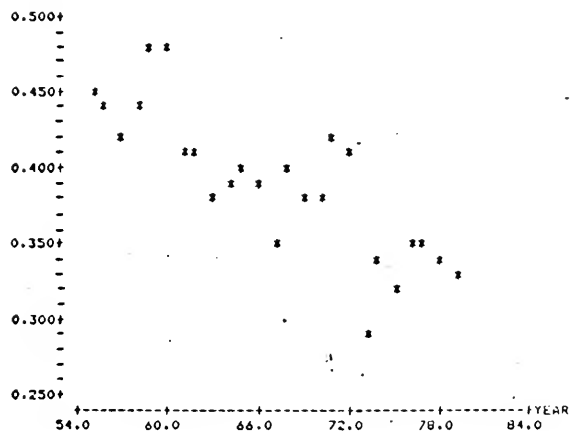


Figure 1(b):

Value Added over Sales  
(Ford)



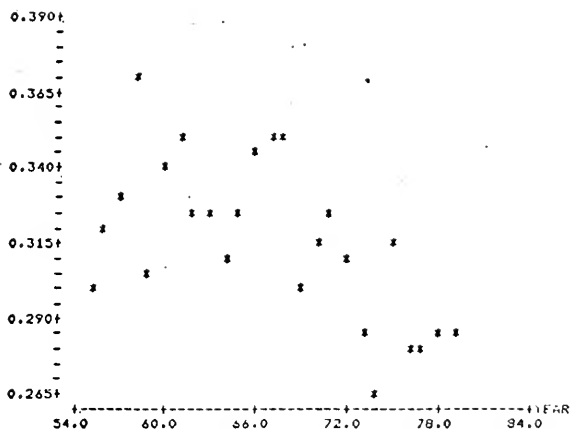


Figure 1(c):

Value Added of Cost of Goods  
Sold over Cost of Goods Sold  
(GM)

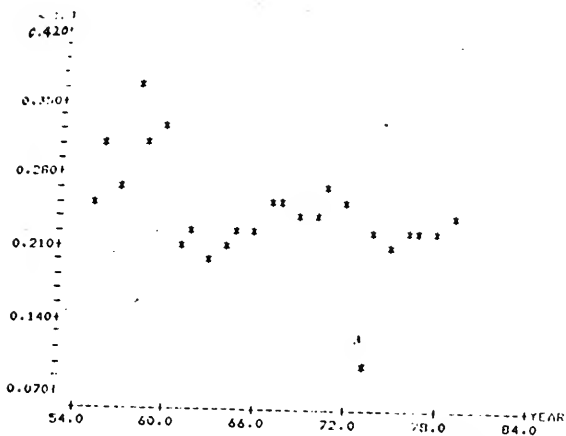


Figure 1(d):

Value Added of Cost of Goods  
Sold over Cost of Goods Sold  
(Ford)



## II. DIMENSIONS OF PRODUCTIVITY

### A. Theoretical Definition of Average and Marginal Productivity

Value added for year t has been defined in Working Paper SSH 1234-82 as revenues adjusted for increases/decreases in inventory costs minus cost of materials, or

$$VA_t = NS_t^{\text{adj}} - M_t \quad (1)$$

where

$VA_t$  = Value Added in year t

$NS_t^{\text{adj}}$  = Revenues adjusted for inventory cost in year t

$M_t$  = Cost of materials in year t

Operating profit can be defined as revenues adjusted for increases/decreases in inventory costs minus cost of labor (approximated in our case by payroll and benefits) minus cost of capital (approximated in our case by depreciation) minus cost of materials, or

$$OP_t = NS_t^{\text{adj}} - PB_t - D_t - M_t \quad (2)$$

where

$OP_t$  = Operating Profit in year t

$NS_t^{\text{adj}}$  = Revenues adjusted for inventory cost in year t

$PB_t$  = Payroll and Benefits in year t

$D_t$  = Depreciation in year t

$M_t$  = Cost of Materials in year t



Combining equations (1) and (2) we get the average productivity equation,

$$VA_t = P3_t + D_t + OP_t \quad (3)$$

or

$$\frac{VA}{P3}_t = 1 + \frac{D}{P3}_t + \frac{OP}{P3}_t \quad (4)$$

It follows from the above analysis that the change of productivity over time can be given by the marginal productivity equation.

$$\frac{VA}{P3}_{t+1} - \frac{VA}{P3}_t - \frac{D}{P3}_{t+1} + \frac{D}{P3}_t - \frac{OP}{P3}_{t+1} + \frac{OP}{P3}_t = 0 \quad (5)$$

The possible combinations for change in productivity and its dimensions are given in Table 1. For example, Case a depicts the possibility that all three ratios (value added over payroll and benefits, depreciation over payroll and benefits and operating profits over payroll and benefits) increase over time; Case b depicts a positive change in value added over payroll and benefits and operating profits over payroll and benefits and a negative change in depreciation over payroll and benefits. The rest of the Cases follow by simple permutation.

The six cases presented in Table 2 cover exhaustively all potential changes in the percentage contributions of the dimensions of value added. Assuming that such changes occur randomly, the ex





ante probability that each of the above six cases will happen is 1/6. Any statistically significant deviation from the probability of 1/6, refutes the null hypothesis of random occurrence or "random walk" and poses the possibility of another causal factor explaining the phenomenon.

Change in (from t to t+1)	Sign of Changes in Ratios					
	Case a	Case b	Case c	Case d	Case e	Case f
$\frac{VA}{P3}$	+	+	+	-	-	-
$\frac{D}{P3}$	+	-	+	-	-	+
$\frac{OP}{P3}$	+	+	-	-	+	-
Probability	1/6	1/6	1/6	1/6	1/6	1/6

Note: Changes of zero magnitude have an ex ante zero probability of occurrence.

Table 1

#### B. Empirical Application of Average Productivity Equation

In Working Paper SSM 1234-82 we have presented the time series of the value added over payroll and benefits. In Figures 2 and 3 we present the time series of a) value added, b) depreciation and c) operating profits over payroll and benefits for General Motors and Ford respectively. This time series analyses, based on Equation (4), allows us to compare the behavior of our average productivity measure, namely value added over payroll and benefits, with the behavior of its dimensions, namely depreciation and operating profits over payroll and benefits.



We observe in Figures 2(a), 3(a) that our measure of average productivity, value added over payroll and benefits, is clearly declining. It should be noted that General Motors average productivity started declining in 1963 and Fords' in 1962. Our measure has also captured shocks such as strikes (1970 for General Motors, 1967 for Ford) and energy price increases (1974, 1979 for General Motors and 1973, 1979 for Ford subject to their accounting policies), which resulted in low outliers because of their negative impact on value added.

The dimensions of productivity offer another view of the dramatic decline experienced by GM and Ford in the past fifteen years. Depreciation and operating profits over payroll and benefits are consistently declining for both General Motors and Ford.

Since the depreciation measure in Figures 2(b), 3(b) is a mixture of previous and current investments, we examined the ratio of depreciation over payroll and benefits in constant dollars discounted by the Consumers Price Index (CPI). We observe that this ratio is increasing, which indicates that the "true" behavior of the consumption of capital as a fraction of payroll and benefits is an intermediate case between the extreme cases depicted in Figures 2(b), 2(c) and 3(b), 3(c). We tend, however, to hypothesize that a gently declining pattern represents reality more closely, because the pattern of capital expenditures over payroll and benefits (current, lagged or led by one year) is also declining, as shown in Figures 2(d,e,f) and 3(d,e,f).

The operating profits over payroll and benefits measure has also captured the shocks from strikes and energy price hikes, as shown in Figures 2(g), 3(g). Later we will examine the relative growth of the various components of value added and hence show more explicitly the



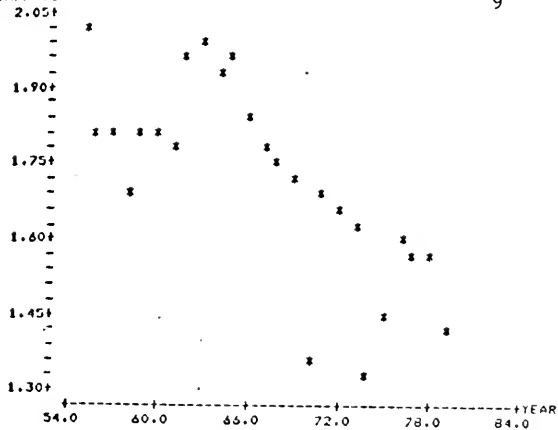


Figure 2(a):

Value Added over Payroll  
and Benefits (GM)

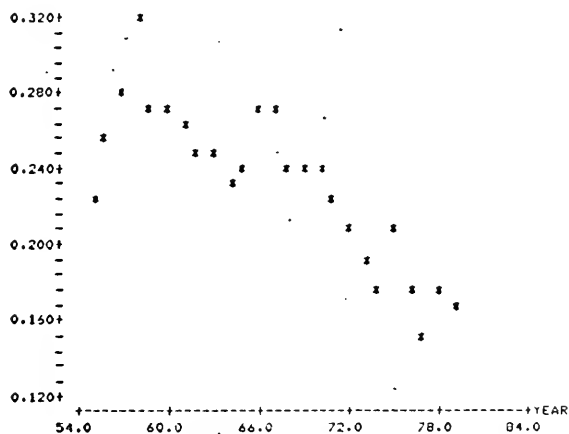


Figure 2(b):

Depreciation over Payroll  
and Benefits (GM)

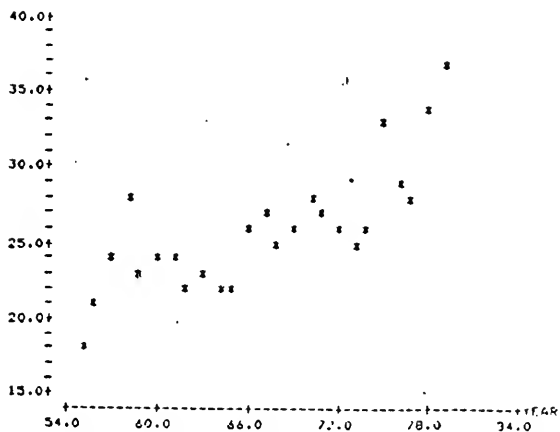


Figure 2(c):

Depreciation over Payroll  
and Benefits in Constant Dollars  
(GM)



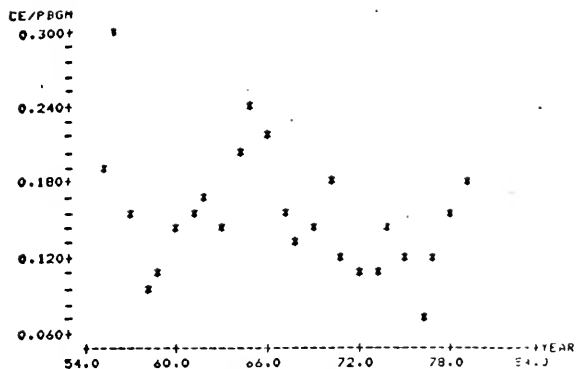


Figure 2(d):

Capital Expenditures (Current Year)  
over Payroll and Benefits (GM)

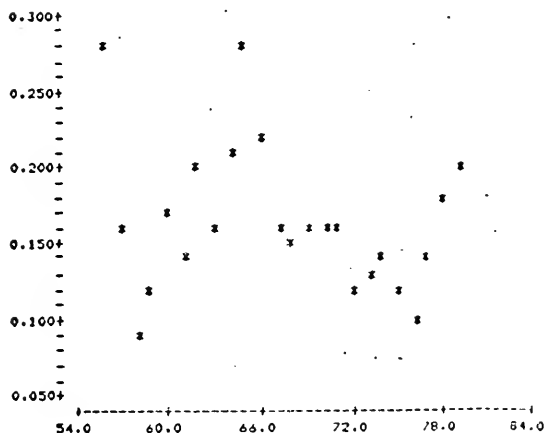


Figure 2(e):

Capital Expenditures (One Year Lag)  
over Payroll and Benefits (GM)

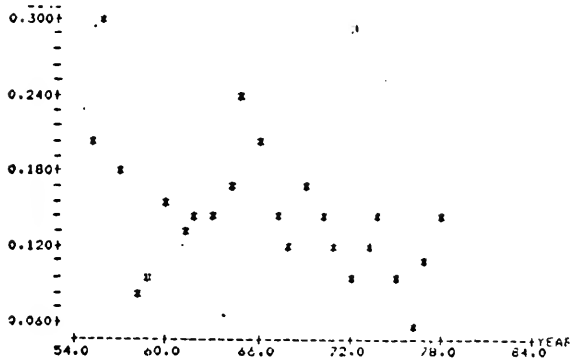


Figure 2(f):

Capital Expenditures (One Year Lag)  
over Payroll and Benefits (GM)





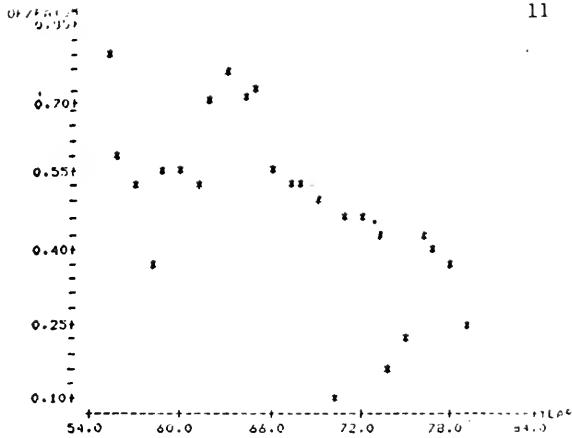


Figure 2(g):

Operating Profits over Payroll  
and Benefits (G1)



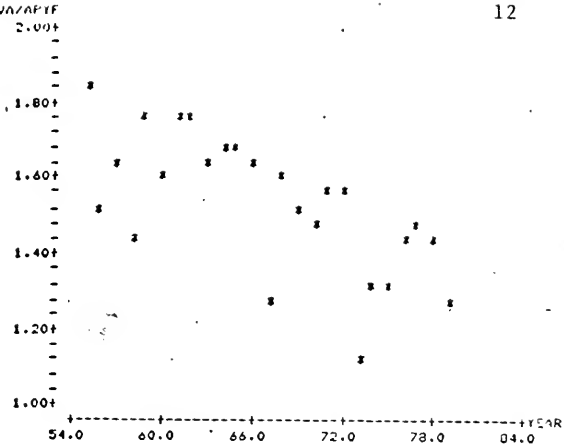


Figure 3(a):

Value Added over Payroll  
and Benefits (Ford)

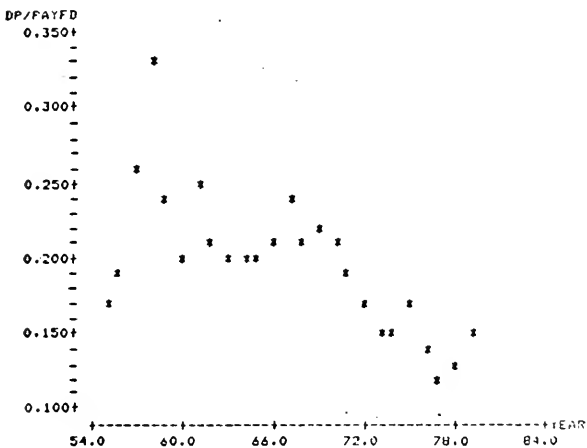


Figure 3(b):

Depreciation over Payroll  
and Benefits (Ford)

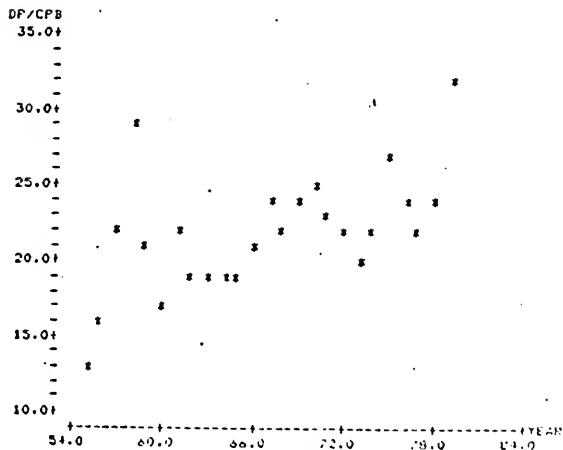


Figure 3(c):

Depreciation over Payroll  
and Benefits in Constant Dollars  
(Ford)



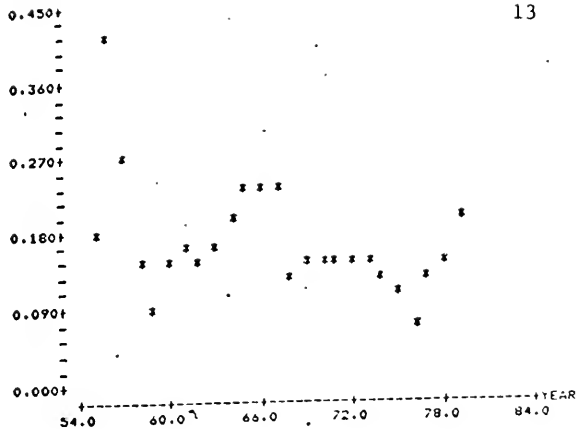


Figure 3(d):

Capital Expenditures (Current Year)  
over Payroll and Benefits (Ford)

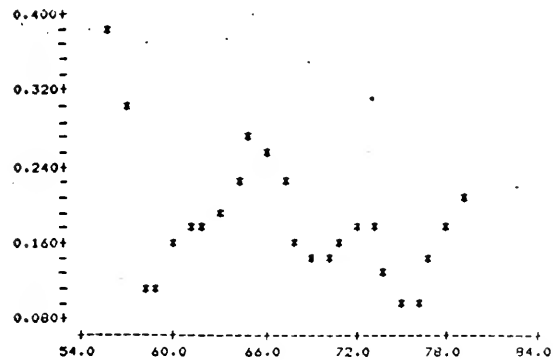


Figure 3(e):

Capital Expenditures (One Year Lag)  
over Payroll and Benefits (Ford)

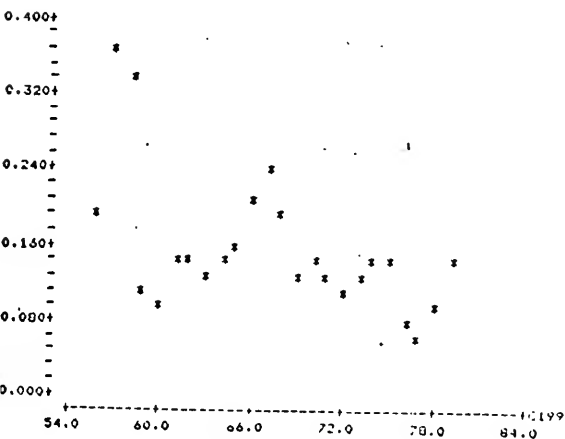


Figure 3(f):

Capital Expenditures (One Year Lead)  
over Payroll and Benefits (Ford)



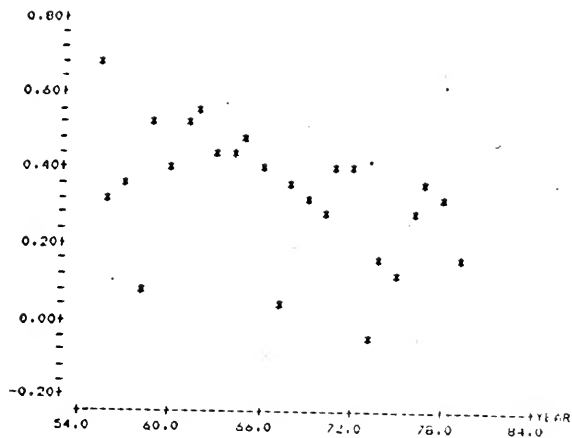


Figure 3 (c):

Operating Profits over  
Payroll and Benefits  
(Ford)





conclusions that are deduced from Figures 2 and 3. However, we can already discern that the rate of increase of payroll and benefits exceeded the rate of change of the other components of productivity.

Finally, we observe that the approximate percentage increases (decreases) of our productivity measure and its dimensions in nominal dollars, for both General Motors and Ford are approximately 25%, (30%) and (65%) in the past fifteen years. We can thus deduce that the increase of payroll and benefits primarily happened at the expense of operating profits.

#### C. Empirical Application of Marginal Productivity Equation

In Figures 4 and 5 we present the time series of yearly change in value added, depreciation and operating profit each divided by payroll and benefits for General Motors and Ford respectively. This time series analysis, based on Equation (5), allows us to compare the behavior of our marginal productivity measure, namely change over time of value added over payroll and benefits, with the behavior of its dimensions, namely change over time of depreciation and operating profits over payroll and benefits.

We observe that the changes over time in value added, depreciation and operating profit over payroll and benefits for General Motors and Ford present a pattern clearly deviating from a uniform "random walk", given that the probability of a negative change in value added over payroll and benefits is approximately 70%. Hence, we refute the null hypothesis of a purely random movement of changes in productivity and its dimensions and recognize the need for a causal diagnosis of the phenomenon.







### III. DIMENSIONS OF VALUE ADDED

#### A. Theoretical Definitions

All meaningful measures of productivity use value added as their numerator, as explained in Working Papers SSM #1251-81 and SSM #1234-82. In our research we have proved the supremacy of value added over payroll and benefits measure, at least in the case of the automobile industry. In any case, however, it is theoretically and empirically necessary to analyze the dimensions of value added in order to shed more light to the behavior of the numerator of productivity measures.

It follows from Equation (3) that the dimensions of value added are payroll and benefits, depreciation and operating profits. Hence,

$$\frac{PB_t}{VA_t} + \frac{D_t}{VA_t} + \frac{OP_t}{VA_t} = 1 \quad (6)$$

Equation (6), which follows from the definition of value added, traces over time the percentage contribution of the dimensions of value added. The change over time of the percentage contributions of the dimensions of value added is given by

$$\frac{PB_{t+1}}{VA_{t+1}} - \frac{PB_t}{VA_t} + \frac{D_{t+1}}{VA_{t+1}} - \frac{D_t}{VA_t} - \frac{OP_{t+1}}{VA_{t+1}} - \frac{OP_t}{VA_t} = 0 \quad (7)$$

The possible combinations for change of the percentages are given in Table 2, constructed similarly to Table 1.



Change in (from t to t+1)	Sign of Changes in Ratios					
	Case a	Case b	Case c	Case d	Case e	Case f
$\frac{PB}{VA}$	+	+	+	-	-	-
$\frac{D}{VA}$	+	-	-	+	+	-
$\frac{OP}{VA}$	-	+	-	+	-	+
Probability	1/6	1/6	1/6	1/6	1/6	1/6

Note: Changes of zero magnitude have an ex ante zero probability of occurrence.

Table 2

Although the changes in the percentage contribution of the dimensions of value added explain their relative significance in the composition of value added, a more detailed analysis is necessary in order to examine the relative rate of change of these dimensions vis-a-vis value added. In order to measure this relative rate of change we employ Equation (3) and derive

$$\frac{PB_{t+1}}{VA_{t+1}} - \frac{PB_t}{VA_t} + \frac{D_{t+1}}{VA_{t+1}} - \frac{D_t}{VA_t} + \frac{OP_{t+1}}{VA_{t+1}} - \frac{OP_t}{VA_t} = 1 \quad (8)$$

Each term of Equation (8) gives over time the relative change of the dimensions of value added vs. the change in value added. We present the possible combinations for change of the dimensions in Table 3, constructed similarly to Table 1.





Change in (from t to t+1)	Sign of Changes in Ratios					
	Case a	Case b	Case c	Case d	Case e	Case f
VA	+	+	+	-	-	-
PB	+	+	+	+	+	+
O	-	+	-	-	+	-
Probability	1/6	1/6	1/6	1/6	1/6	1/6

Note: Changes of zero magnitude have an ex ante zero probability of occurrence.

Table 3

We can again check the null hypothesis of random occurrence and consequently of probability 1/6 and also examine, in case of significant deviation, the possibility of some causal factor explaining the phenomenon.

An alternative presentation of relative rates of changes can be done by using value-added "elasticities" of the dimensions of value added. The sole purpose of this alternative representation is to put relative changes in terms of familiar percentage change ratios, or

$$e_t^{PDV} = \frac{PB_{t+1} - PB_t}{VA_{t+1} - VA_t} \cdot \frac{VA_t}{PB_t} \quad (9a)$$

$$e_t^{DV} = \frac{D_{t+1} - D_t}{VA_{t+1} - VA_t} \cdot \frac{VA_t}{D_t} \quad (9b)$$

$$e_t^{OPV} = \frac{OP_{t+1} - OP_t}{VA_{t+1} - VA_t} \cdot \frac{VA_t}{OP_t} \quad (9c)$$



## B. Empirical Application of Percentage Contribution Equation

Using the U.S. Automobile industry as our empirical domain we will test the hypotheses raised in the previous section. We present in Figures 6 and 7 the time series of the percentage contributions of the dimensions of value added for General Motors and Ford respectively.

We observe in Figures 6(a), 7(a) that the percentage contribution of payroll and benefits to value added (inverse of our productivity measure) is obviously increasing. We note again the existence of outliers, for both General Motors and Ford, due to strikes (1967 and 1970) and energy price increases (1973-74 and 1979).

We can hypothesize that the growth rate of payroll and benefits is greater than the growth rate of value added. We will test whether the difference in growth rates is statistically significant. We test this hypothesis by separately regressing the index of payroll and benefits and the index of value added over time. Then, we test whether the coefficients of time in two regressions are significantly different.



The regressions are the following:

$$PB(GM) = -18.3 + 0.182t$$

(s.d. = 0.01644)

$$VA(GM) = -12.4 + 0.126t$$

(s.d. = 0.012520)

$$PB(FORD) = -26.2 + 0.257t$$

(s.d. = 0.02233)

$$VA(FORD) = -18.5 + 0.184t$$

(s.d. = 0.01708)

The t-test shows that the coefficients of time for payroll and value added are significantly different for both firms. Actually the t-statistic is 13.17 for GM and 18.36 for Ford, meaning both are significantly at 0.01 level. Therefore, we conclude that for these two firms, payroll and benefits has increased significantly faster than value added.

The percentage contribution of depreciation to value added for General Motors shown in Figure 6(b), has been declining in two stages; from 1958 to 1965 and from 1966 to 1977 with a quantum leap from 1965 to 1966, while an upward trend started in 1978 reflecting increased capital spending. For Ford, the percentage contribution of depreciation to value added shown in Figure 7(b) has been rather stable and on the average slightly declining. An upward trend for Ford has also started in 1978. Since depreciation reflects a mixture of various vintages of capital, we also present the percentage contribution of depreciation to value added measured in constant dollars discounted by the New Car Price Index (NCPI) in Figures 6(c) and 7(c). We observe that the adjusted ratio behaves similarly to the unadjusted ratio. Furthermore we calculated the



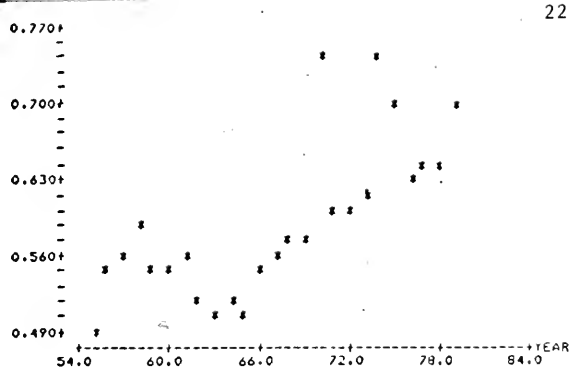


Figure 6(a):

Payroll and Benefits over Value Added (GM)

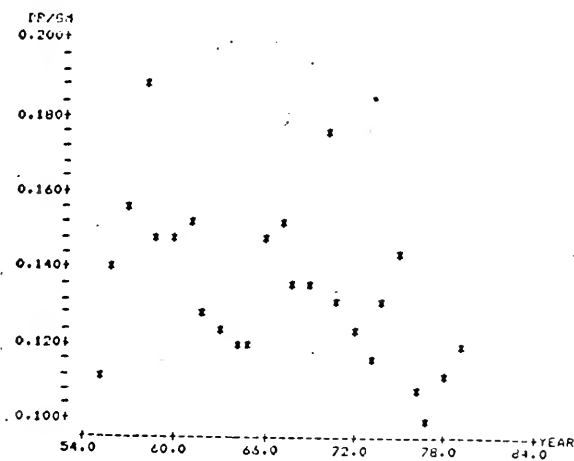


Figure 6(b):

Depreciation over Value Added (GM)

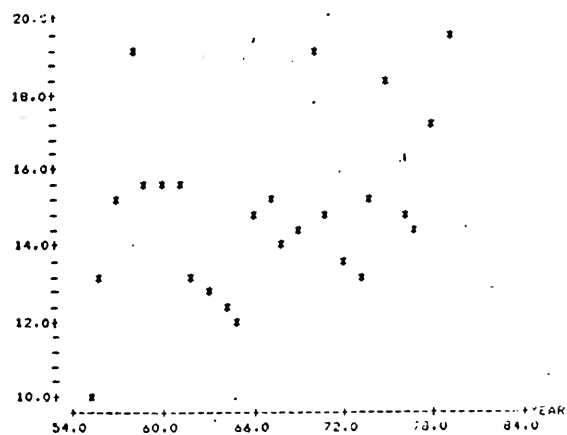


Figure 6(c):

Depreciation over Value Added in Constant Dollars (GM)





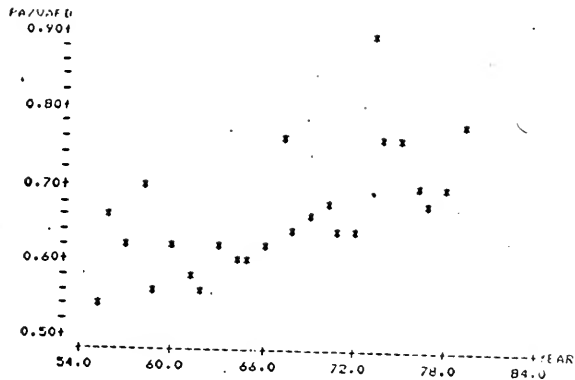


Figure 7(a):

Payroll and Benefits over Value Added (Ford)

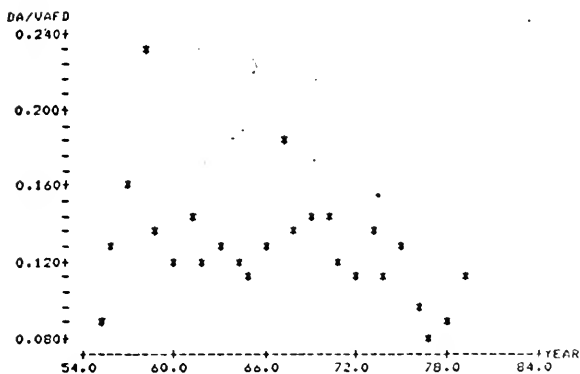


Figure 7(b):

Depreciation over Value Added (Ford)

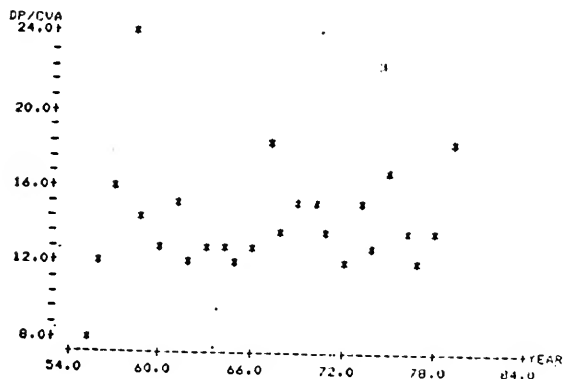


Figure 7(c):

Depreciation over Value Added in Constant Dollars (Ford)



ratios of capital expenditures to value added (current year and lagged by one year) in Figures 6(d,e) and 7(d,e). We observe for both General Motors and Ford a slightly declining or even stable pattern with an obvious upward trend in 1976-77.

The percentage contribution of operating profits to value added for both General Motors and Ford exhibits a four stage evolution. The percentages for GM shown in Figure 6(g), omitting the outliers, are approximately 30% from 1956 to 1961, 36% from 1962 to 1965, 28% from 1966 to 1973 and 20% from 1974 to 1979. The percentages for Ford shown in Figure 7(g), omitting again the outliers, are approximately 22% from 1956 to 1957, 28% from 1958 to 1966, 22% from 1968 to 1972 and 16% from 1973 to 1979. These movements show that the "good" years of growing profitability for the U.S. Automobile industry ended in the mid-sixties, which is consistent with the results of our productivity measure analysis..

Finally we observe that the approximate percentage increases (decreases) of the percentage contribution, of payroll and benefits, depreciation and operating profits value added for GM in the past fifteen years have been 40%, (8%) and (50%). The respective numbers for Ford in the same time period are 30%, (18%) and (67%). We therefore conclude that the increase of the percentage contribution of payroll and benefits to value added can be primarily explained by the decrease of the percentage contribution of operating profits to value added, because the change in the percentage contribution of depreciation to value added is relatively unimportant.



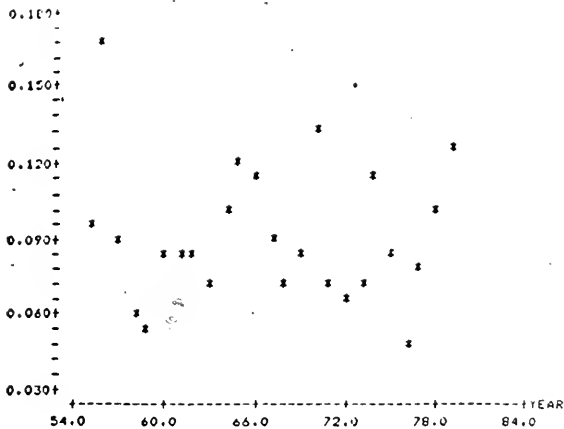


Figure 6(d):

Capital Expenditures (Current Year)  
over Value Added (GM)

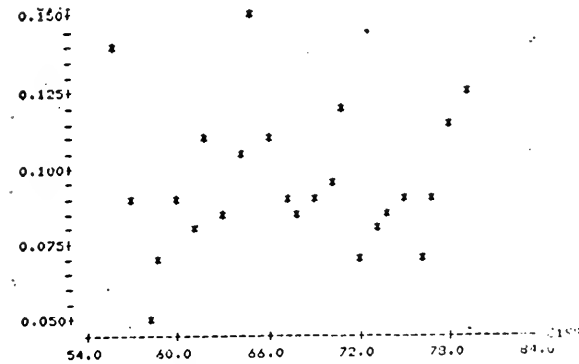


Figure 6(e):

Capital Expenditures (One Year Lag)  
over Value Added (GM)

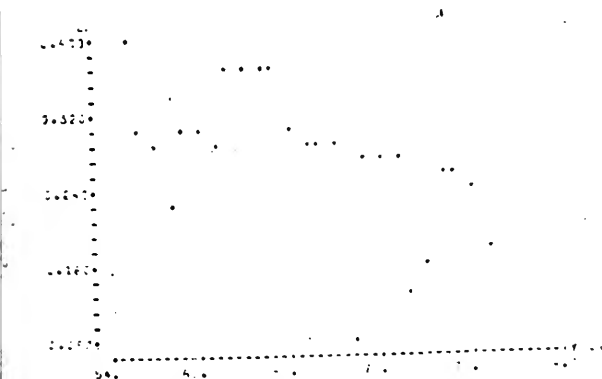


Figure 6(f):

Capital Expenditures (One  
Year Lead) over Value Added  
(GM)



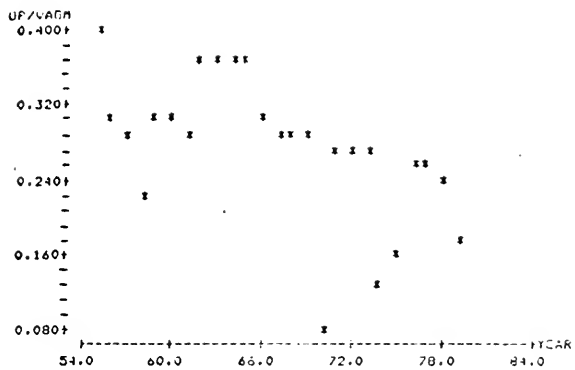


Figure 6(g):

Operating Profits over Value Added  
(GM)





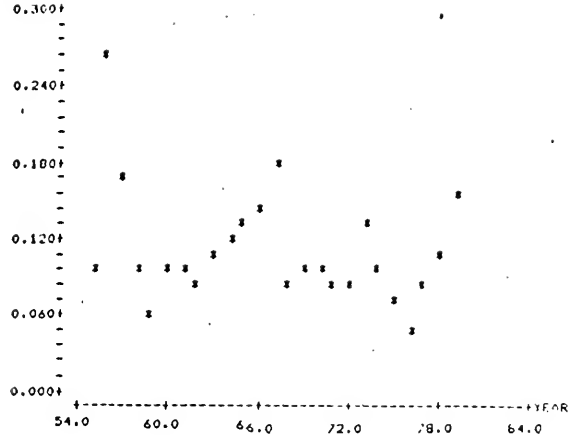


Figure 7(d):

Capital Expenditures (Current Year)  
over Value Added (Ford)

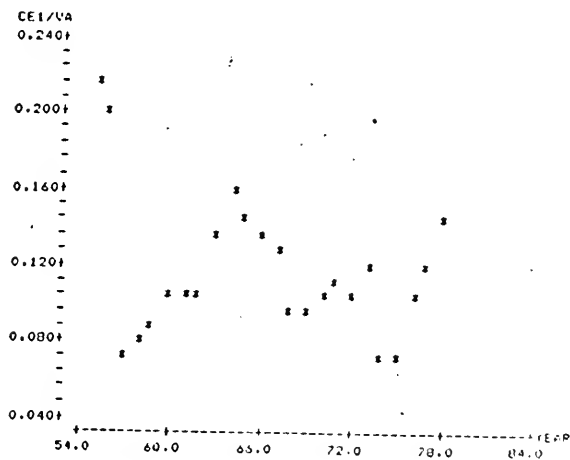


Figure 7(e):

Capital Expenditures (One Year Lag)  
over Value Added (Ford)

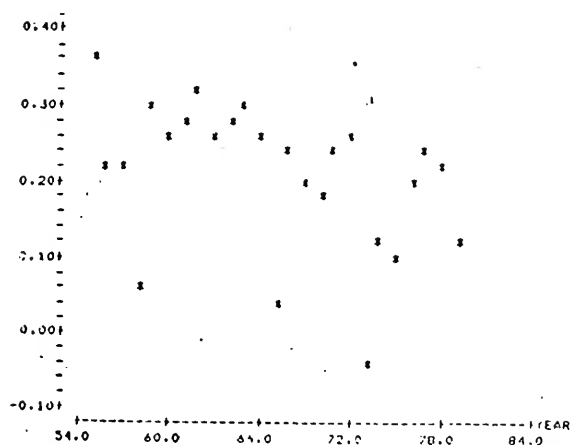


Figure 7(f):

Capital Expenditures (One Year  
Lead) over Value Added (Ford)



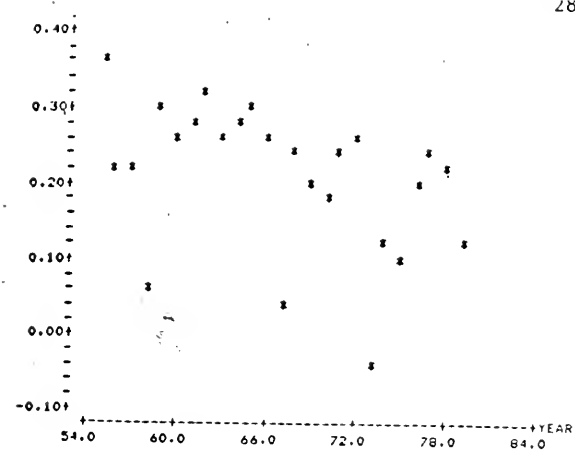


Figure 7(g):

Operating Profits over Value Added  
(Ford)



C. Empirical Application of Changes in Percentage Contribution Equation

In Figures 8 and 9 we present the time series of changes of the percentage contributions of value added for General Motors and Ford respectively.

We observe that the patterns of time series of changes of the percentage contribution of payroll and benefits (high probability of positive changes) and operating profits (high probability of negative change) to value added for General Motors and Ford, clearly deviate from a "random walk", whereas the test for depreciation is indecisive.

In Figures 10 and 11 we present the time series of the relative rates of change of the components of value added for General Motors and Ford respectively.

We observe that the relative rates of change of the components of value added do not follow any "random walk" pattern. Omitting outliers, the time series of the ratio of change in payroll and benefits over change in value added is predominantly positive and for both General Motors and Ford the ratio is on the average around 50%, which implies that changes are of the same sign and that payroll and benefits account on the average for 50% of this change. The time series of the ratio of change in depreciation over change in value added for both General Motors and Ford are predominantly positive and on the average around 7%. The same observation holds for operating profits change over value added change, namely the time series are predominantly positive; the average ratio is around 43%.



Payroll and Benefits	Depreci- ation	Operating Profits
----------------------------	-------------------	----------------------

0.053673	0.0301707	-0.004243
0.055126	0.0154156	-0.021862
0.036754	0.000000	-0.011653
-0.044713	-0.0417401	0.000001
0.000546	0.000000	-0.005486
0.011315	0.0023377	-0.01182
-0.051512	-0.014910	0.075022
-0.012165	-0.0004203	0.014018
0.018004	-0.0074904	-0.01504
-0.002919	-0.000001	0.000719
0.036973	0.0071535	-0.05126
0.013135	0.0055233	-0.01140
0.000044	-0.010000	0.00000
0.010900	0.0011740	-0.010074
0.062040	0.0011103	-0.00000
-0.044551	-0.000000	0.000007
0.001008	-0.000000	0.000000
0.015176	-0.000000	-0.000001
0.029811	0.0011104	-0.011071
-0.049566	0.0011103	0.000000
-0.067506	-0.000000	0.000000
0.012527	-0.000000	0.000000
0.000000	0.0011103	-0.000000
0.061878	0.000000	-0.000000

Figure 8:

Time Series of Changes of Percentage  
Contributions to Value Added (GM)

Payroll and Benefits	Depreci- ation	Operating Profits
----------------------------	-------------------	----------------------

0.111759	0.0346203	-0.146359
-0.040388	0.0329293	0.007469
0.087379	0.0742750	-0.161554
-0.136587	-0.0758154	0.232304
0.052631	-0.0165301	-0.036101
-0.049889	0.0212730	0.028611
-0.006646	-0.0241770	0.030823
0.047330	0.0065736	-0.053003
-0.009056	-0.0021500	0.011245
-0.011694	-0.0070040	0.018698
0.023249	0.0138548	-0.037104
0.156128	0.0540392	-0.210767
-0.137102	-0.0511979	0.108360
0.024091	0.000000	-0.032337
0.017826	0.0018462	-0.019372
-0.038970	-0.0231237	0.062274
0.000376	-0.010000	0.000000
0.264597	0.0255276	-0.293125
-0.139934	-0.0216043	0.166579
0.095005	0.0169482	-0.021954
-0.065716	-0.0277012	0.075677
-0.026470	-0.0164728	0.042943
0.026556	0.000000	-0.031415
0.072425	0.0249546	-0.097379

Figure 9:

Time Series of Changes of Percentage  
Contributions to Value Added (Ford)





Payroll and Benefits	Deprecia- tion	Operating Profits
----------------------------	-------------------	----------------------

Figure 10:

Payroll and Benefits	Deprecia- tion	Operating Profits
----------------------------	-------------------	----------------------

Figure 11:



In Figures 12 (a,b,c) and 13 (a,b,c) we present the value added "elasticities" of the components for General Motors and Ford respectively. The value added "elasticities" of dimensions give us the time series of the ratio of percentage change of each of the three components of value added over percentage change of value added.

We observe that for both General Motors and Ford the average value of the ratio of percentage increases (decreases) changes is around 70% for elasticities of payroll and benefits with respect to value added, (50%) for depreciation and (300%) for operating profits respectively.



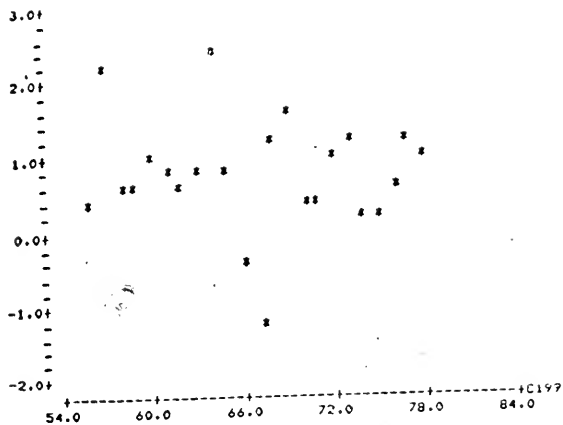


Figure 12(a):

Value Added "Elasticity" of  
Payroll and Benefits  
(GM)

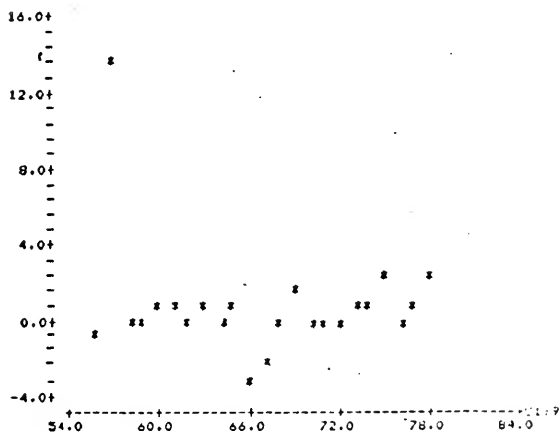


Figure 12(b):

Value Added "Elasticity" of  
Depreciation (GM)

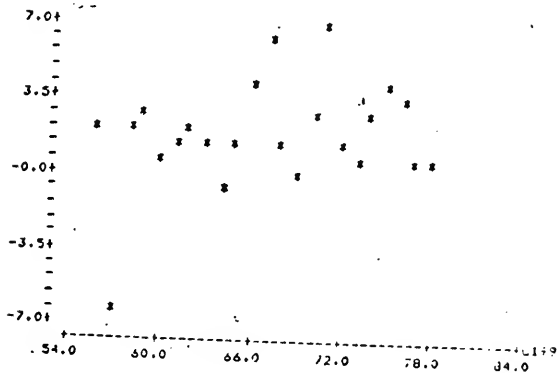


Figure 12(c):

Value Added "Elasticity" of  
Operating Profits (GM)



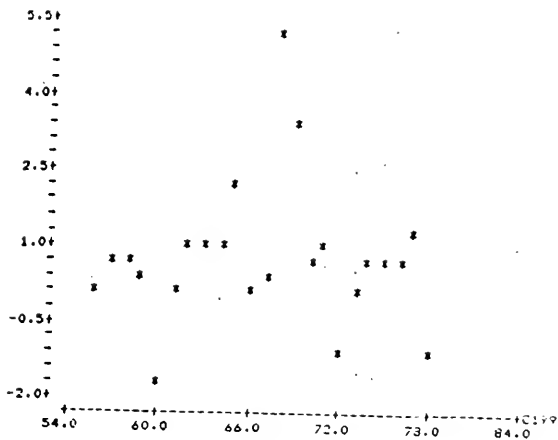


Figure 13(a):

Value Added "Elasticity" of  
Payroll and Benefits  
(Ford)

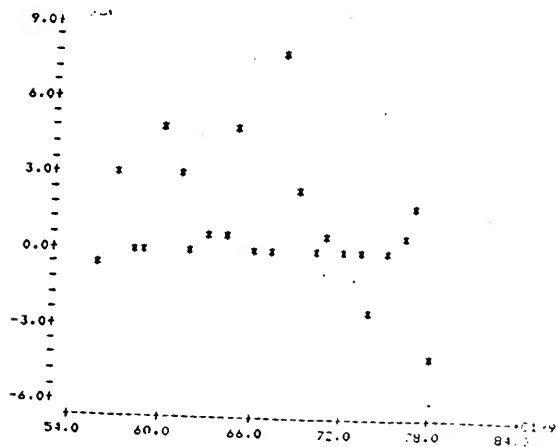


Figure 13(b):

Value Added "Elasticity" of  
Depreciation (Ford)

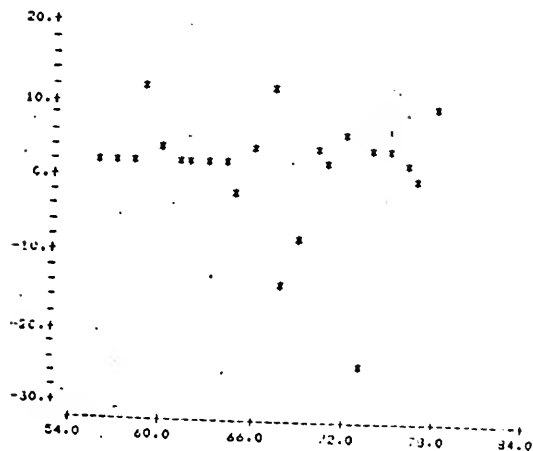


Figure 13(c):

Value Added "Elasticity" of  
Operating Profits (Ford)





#### IV. PRODUCTIVITY MEASUREMENT: COMPARISON WITH MANAGERIAL PERFORMANCE INDICATORS

Since productivity is one of the performance indicators of a firm, we are interested in finding out the relationship between productivity and various performance indicators used by management, such as return on sales, return on investment, etc. These relationships allow us to further explore the role of productivity in the operations of the firm. For the automobile industry, we are particularly interested in finding out the causal relationships among imported cars market share, productivity and profitability.

##### A. Managerial Performance Indicators

There are many criteria commonly used by management to evaluate the performance of a corporation, including return on sales, return on stockholders' equity, return on total assets, return on net property and equipment, and net income, where the term "return" is usually employed either as net income or as operating income (income before taxes, interest and extraordinary items).

Return on sales measures the overall profitability of a firm. A firm may increase its return on sales by reducing unit cost or by increasing prices. The reduction in unit costs reflects the improvement in production efficiency or reduction in value of materials purchased. The increase in prices, holding unit cost constant, reflects the market power of the firm. Therefore, return on sales represents mixed effects of efficiency and market power.



Return on assets (ROA), return on equity (ROE) and on net plant and equipment (ROP) are defined as returns divided by total assets, stockholders' equity, and net property & equipment respectively. ROA indicates how well the firm has utilized all its financial resources, without considering the relative magnitudes of these resources (long-term debt, stockholders' equity). ROA equals ROS divided by the asset turnover rate. Therefore, ROA reflects production efficiency, market power, and the efficiency in utilizing total assets to generate sales.

ROE, obviously, is of interest to present and respective shareholders, and is also of concern to management, which is supposed to operate the business in the stockholder's best interest, because it indicates how well the firm has utilized the shareholder's equity. Return on property and equipment (ROP) is a measure of the efficiency with which fixed assets have been employed.

Each of these four financial ratios can have two possible measures for its numerator (net income and operating income). Thus, we have eight performance indicators, which together with two measures of net income (nominal dollars and constant dollars) will be compared with our productivity measure.

#### B. Time Series of Managerial Performance Indicators

The time series of these ten performance indicators for General Motors and Ford are shown in Figures 14(a-k), 15(a-k). We observe that net income to sales and operating income to sales have patterns similar to our productivity measure. Both ratios have declined smoothly since 1962 for GM and 1959 for FORD. The rest of the ratios either show a cyclical or an increasing pattern that can not provide us with early warning signal.



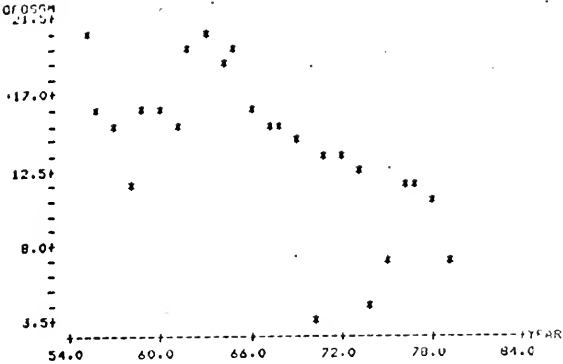


Figure 14(a):

Operating Return to Sales  
(GM)

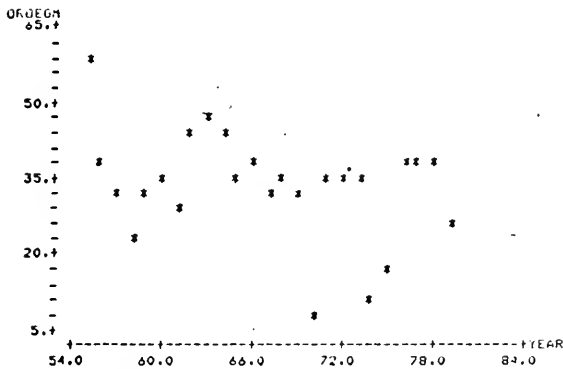


Figure 14(b):

Operating Return to Equity  
(GM)

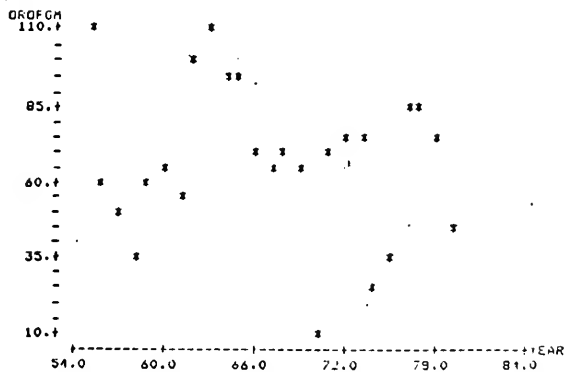


Figure 14(c):

Operating Return to Plant  
and Equipment (GM)



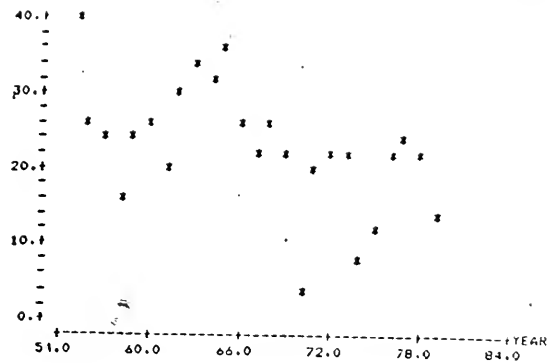


Figure 14(d):

Operating Return on Assets  
(GM)

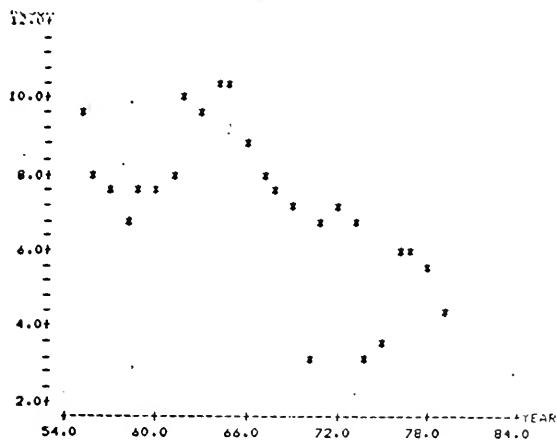


Figure 14(e):

Net Return on Sales  
(GM)

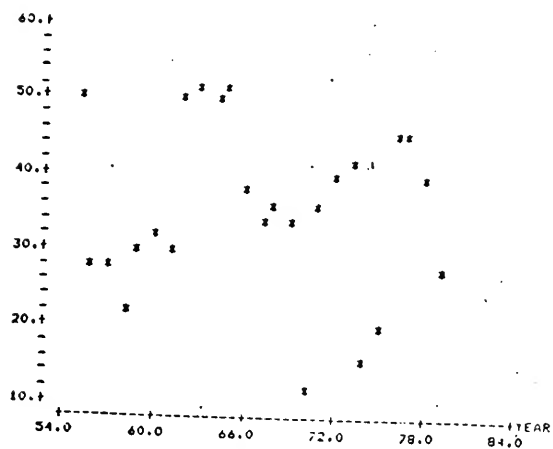


Figure 14(f):

Net Return on Plant and  
Equipment (GM)





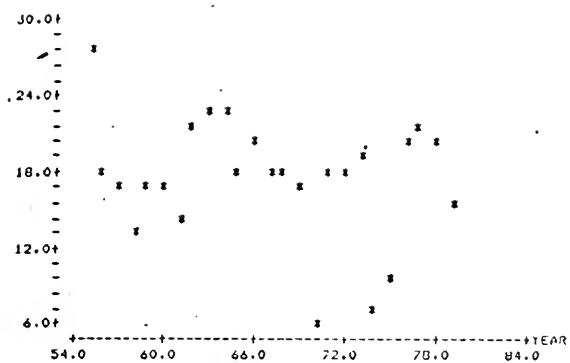


Figure 14(g):

Net Return on Equity  
(GM)

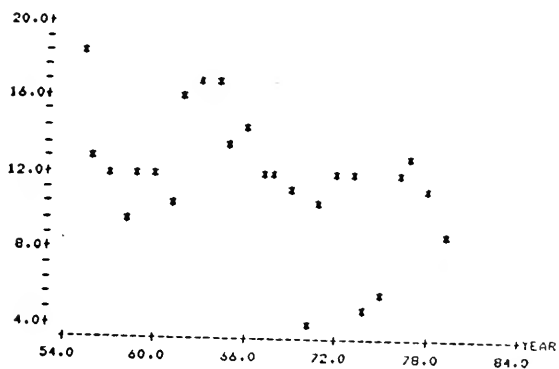


Figure 14(h):

Net Return on Assets  
(GM)

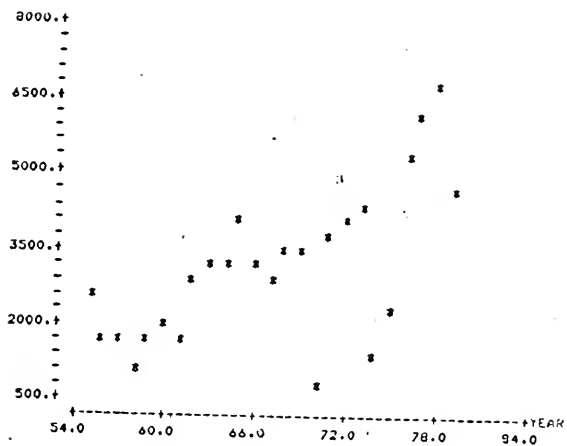


Figure 14(i):

Operating Income  
(GM)



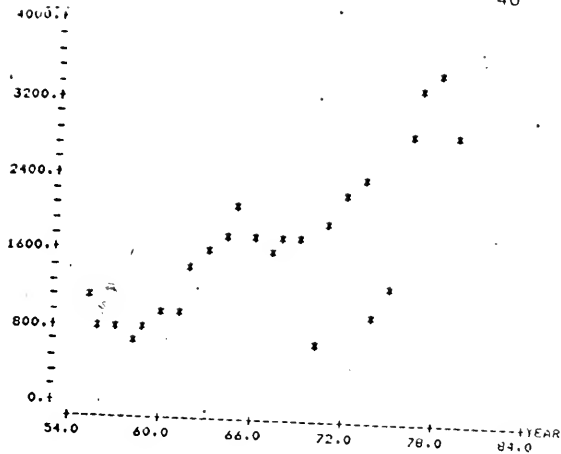


Figure 14(j):

Net Income (GM)

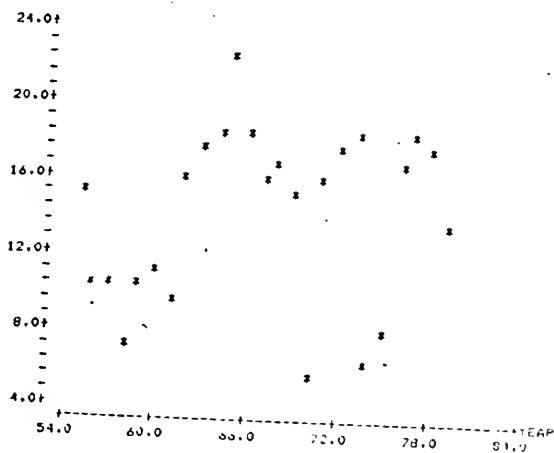


Figure 14(k):

Net Income in Constant Dollars (GM)



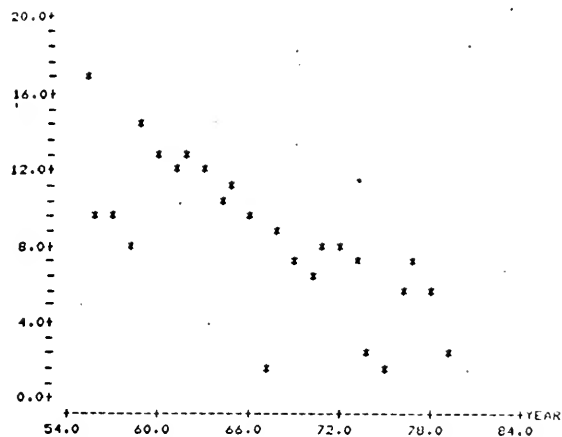


Figure 15(a):

Operating Return to Sales  
(Ford)

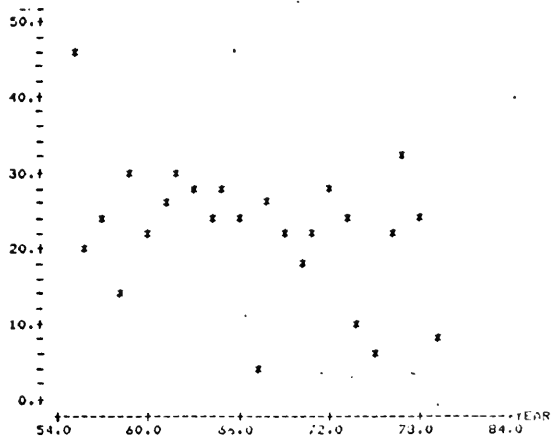


Figure 15(b):

Operating Return to Equity  
(Ford)

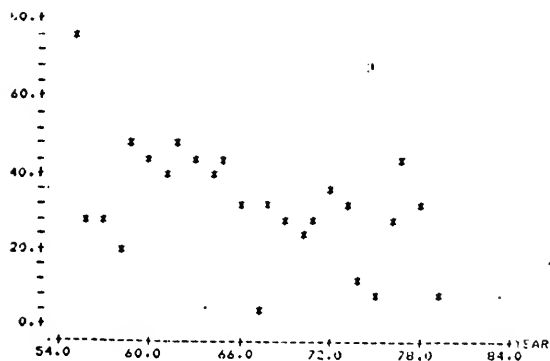


Figure 15(c):

Operating Return to Plant  
and Equipment (Ford)



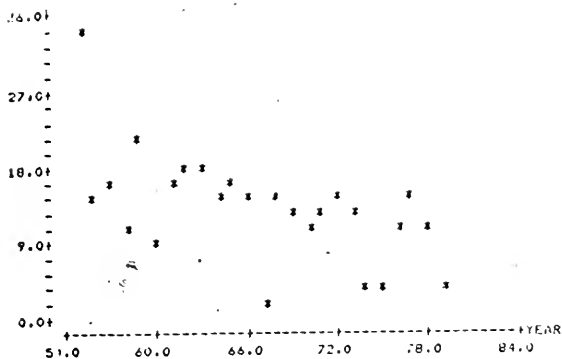


Figure 15(d):

Operating Return on Assets  
(Ford)

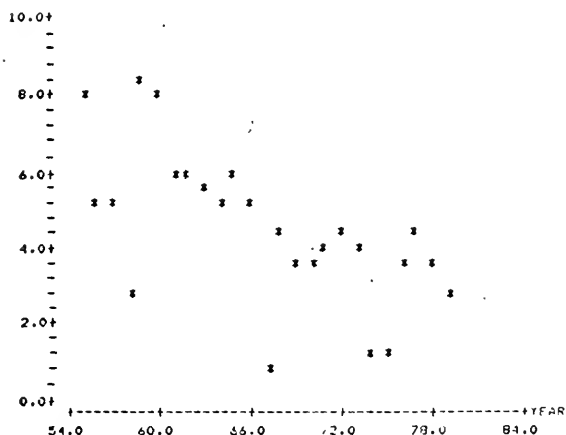


Figure 15(e):

Net Return on Sales  
(Ford)

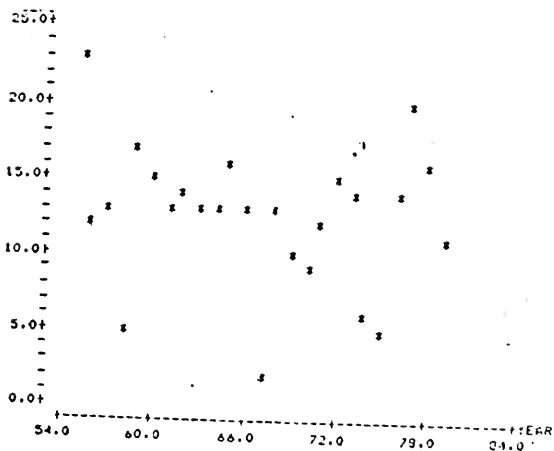


Figure 15(f):

Net Return on Plant and  
Equipment (Ford)





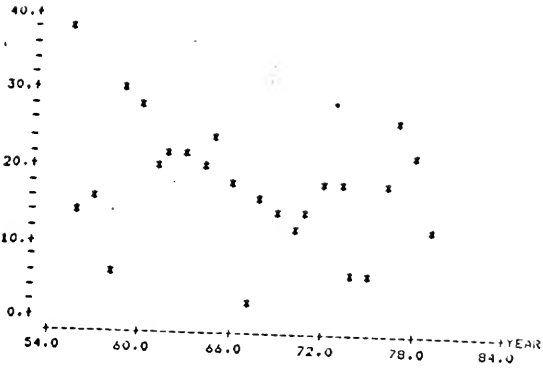


Figure 15(c):

Net Return on Equity  
(Ford)

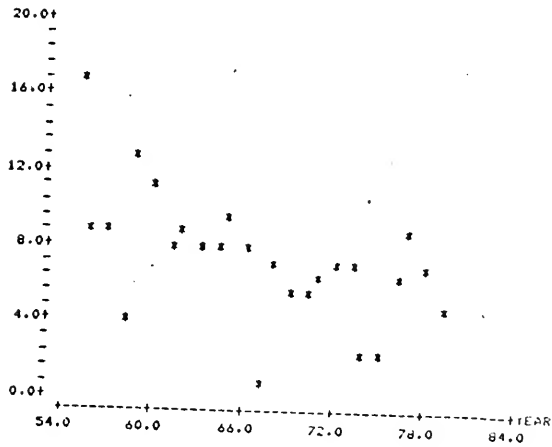


Figure 15(h):

Net Return on Assets  
(Ford)

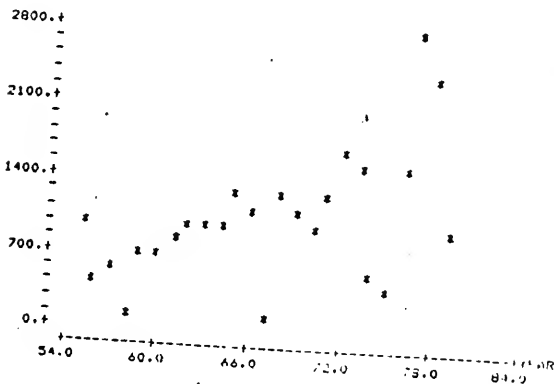


Figure 15(i):

Operating Income (Ford)



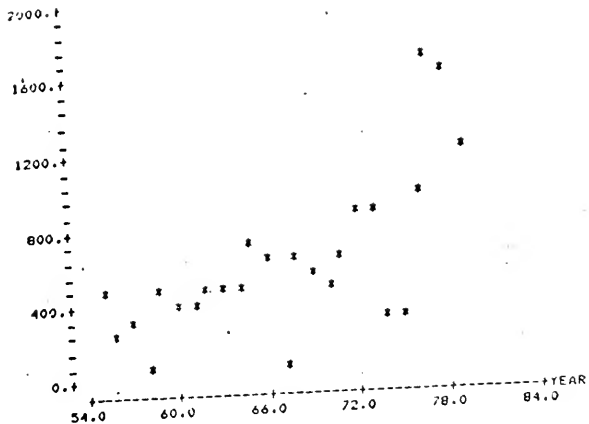


Figure 15(j):

Net Income (Ford)

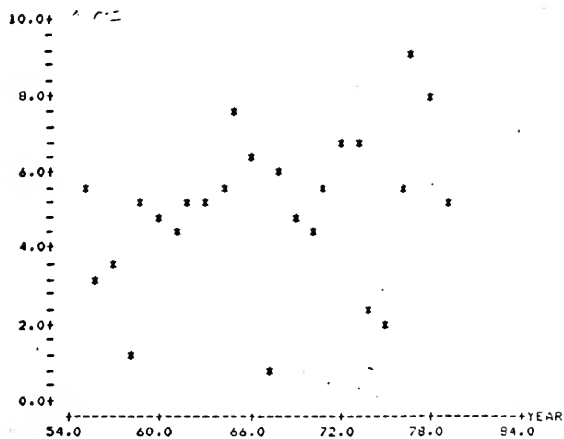


Figure 15(k):

Net Income in Constant  
Dollars (Ford)



The correlation coefficients of our productivity measure with the managerial performance indicators are shown in Figure 16(a,b) for GM and Ford. Value added per dollar of salaries and benefits is highly correlated with operating income to sales (OROS) and net income to sales (ROS) for both companies; the correlation coefficients are 0.938, 0.977 for GM, 0.868, 0.807 for FORD. Therefore, productivity may explain most of the variance of ROS and OROS.

The time series and correlation coefficients indicate that operating income to sales and net income to sales may be used as a surrogate measure of productivity, and hence provide managers with a quick diagnosis of the condition of their firms.

Two arguments complement our findings. First, the book value of property, assets, and stockholders' equity are the accumulation of past investments which are in nominal dollars of the respective years. Thus, the book value of these items is not homogeneous longitudinally. Sales and return figures are in current year dollars. Hence, in terms of homogeneity, only OROS and ROS are consistent with our productivity measure.

Second, net income is affected by "financial operations" such as the debt-equity ratio, extraordinary items and tax rates have nothing to do with the production efficiency of a firm. Operating income is an item without this deficiency and thus is theoretically superior to net income in measuring efficiency. Combining the above two arguments, we find that theoretically and empirically, operating income to sales describes best the performance of the firm among various performance indicators.

Since value added over payroll is highly correlated to OROS, we attempt in the following to test the relationships among three variables affecting performance: operating income to sales, productivity, and imported cars



	VA/PAYG	ROAGM	ROEGM	ROSGM	ROPGM	OROAGM	OROEGM	OROSGM	OROPGM
ROAGM	0.891								
ROEGM	0.733	0.951							
ROSGM	0.977	0.910	0.770						
ROPGM	0.671	0.856	0.910	0.749					
OROAGM	0.923	0.922	0.879	0.922	0.860				
OROEGM	0.781	0.953	0.992	0.782	0.877	0.929			
OROSGM	0.988	0.924	0.975	0.982	0.751	0.954	0.837		
OROPGM	0.737	0.899	0.927	0.750	0.785	0.910	0.924	0.811	
NIGM	-0.204	0.160	0.401	-0.075	0.514	0.119	0.286	-0.036	0.423
OIGM	-0.102	0.251	0.486	0.014	0.592	0.222	0.398	0.020	0.518

ROAGM = Return on Assets (GM)  
 ROEGM = Return on Equity (GM)  
 ROSGM = Return on Sales (GM)  
 ROPGM = Return on Plant (GM)  
 NIGM = Net Income (GM)

OROAGM = Operating Return on Assets (GM)  
 OROEGM = Operating Return on Equity (GM)  
 OROSGM = Operating Return on Sales (GM)  
 OROPGM = Operating Return on Plant (GM)  
 OIGM = Operating Income (GM)

VA/PAY = Value Added over Payroll and Benefits

Figure 16(a) (GM)

	VA/PAYF	ROAFD	ROEFD	ROSFd	ROPFd	OROAFD	OROEFD	OROSFD	OROPFD
ROAFD	0.737								
ROEFD	0.558	0.886							
ROSFd	0.807	0.943	0.773						
ROPFd	0.674	0.953	0.942	0.889					
OROAFD	0.730	0.886	0.758	0.805	0.810				
OROEFD	0.711	0.837	0.912	0.799	0.703	0.921			
OROSFD	0.858	0.896	0.883	0.945	0.810	0.950	0.837		
OROPFD	0.774	0.935	0.875	0.861	0.948	0.774	0.962	0.906	
NIFD	-0.195	0.103	0.531	-0.057	0.422	-0.033	0.263	-0.185	0.135
OIFD	-0.023	0.202	0.618	0.025	0.471	0.145	0.427	-0.025	0.310

ROAFD = Return on Assets (Ford)  
 ROEFD = Return on Equity (Ford)  
 ROSFD = Return on Sales (Ford)  
 ROPFD = Return on Plant (Ford)  
 NIFD = Net Income (Ford)

OROAFD = Operating Return on Assets (Ford)  
 OROEFD = Operating Return on Equity (Ford)  
 OROSFd = Operating Return on Sales (Ford)  
 OROPFd = Operating Return on Plant (Ford)  
 OIFD = Operating Income (Ford)

VA/PAY = Value Added over Payroll and Benefits

Figure 16(b) (Ford)





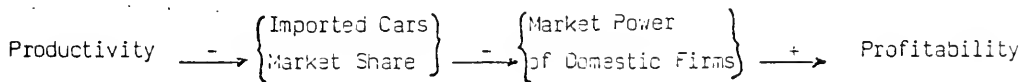
market share. We believe that these three variables can elucidate the problems of the U.S. Automobile industry.

### C. Model Testing

In this section, we will test two models. The first model is symptomatic assuming that imported cars market share is an intervening variable between profitability and productivity. The second model assumes that productivity is the underlying cause of both imports market share and profitability.

#### 1. Model 1

Market share of imported cars has increased since 1963 as shown in Figure 17. One plausible explanation is that the decline of the U.S. productivity allowed imports to penetrate the U.S. market. As a result the market shares of existing firms as well as their market power in raising prices declined, and thus their profitability fell. Thus, the first model is one where productivity affects imported cars market share which in turn, affects profitability. Model 1 is shown as follows:



Model 1

The arrows indicate the causal relationships and the signs indicate the positive or negative effect of the causal relations.



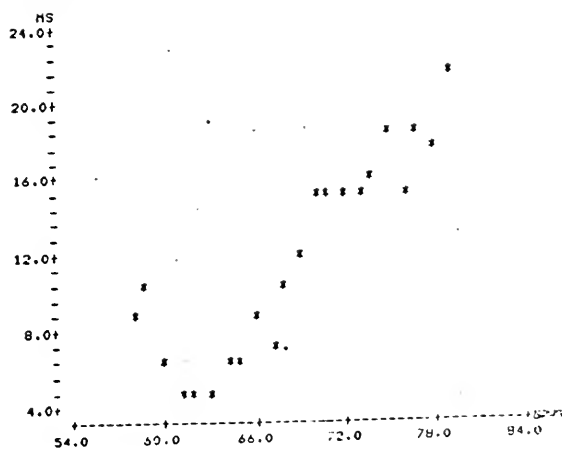


Figure 17:

Imported Cars Market Share

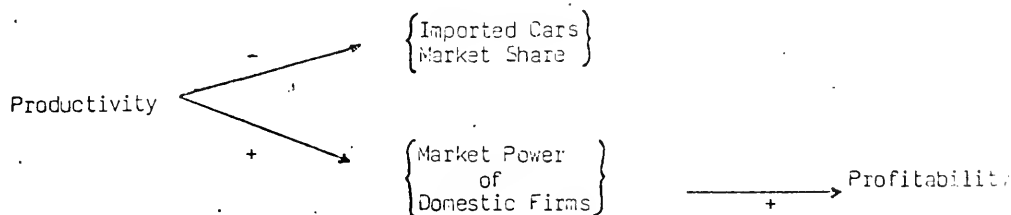


It should be noted that Model 1 assumes that productivity will affect profitability through market share which permits the firm to raise its price above its average cost.

A piece of evidence supporting Model 1 is that the ratio of new car price index to auto producer price index shown in Figure 18 has declined since 1963, which is highly negatively related to the imported cars market share. The correlation coefficient is -0.913. A plausible hypothesis is therefore that U.S. automobile manufacturers had market power to by-pass their cost increase to consumers before the penetration of foreign cars, but not afterwards.

## 2. Model 2

A very strong assumption in Model 1 is that productivity affects profitability through market share increase or decrease. However, one may argue that in a market without collusion, the efficient firm will have lower average cost and is therefore able to act as a price leader who has market power to raise or lower prices. Therefore, market share does not affect profitability and the high negative correlation between imports market share and domestic firms' profitability is spurious. Therefore, the model becomes:



Model 1



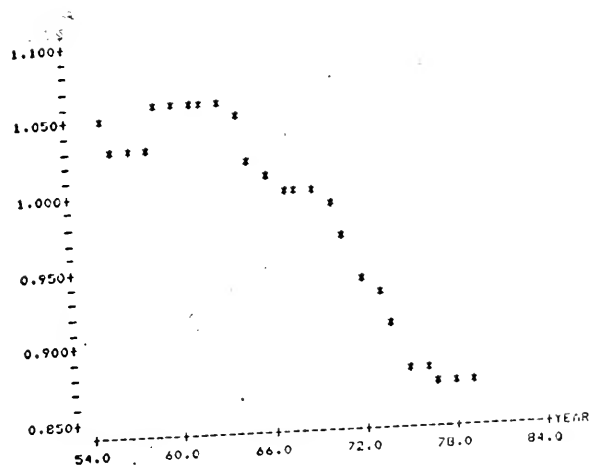


Figure 18:

New Car Price Index  
over Producer Price  
Index (Automobile  
Industry)





The difference between Model 1 and Model 2 is that Model 1 attributes the profitability to the "price effect", while Model II attributes its "cost effect".

### 3. Statistical Results

If the relationships of Model 1 hold, the partial correlation coefficient between profitability and productivity should drop substantially after we controlled for market share of imported cars. However, if the relationships of Model 2 hold, then the partial correlation coefficient between imported cars market share and profitability should drop, after controlling for productivity.

In the present study, we use operating income to sales (OROS) as the measure of profitability. Let  $p_{ab}$  be the zero-order correlation coefficient between variables  $a$  and  $b$ , and  $p_{ab.c}$  be the partial correlation coefficient between  $a$  and  $b$ , after controlling for  $c$ . The zero-order correlation coefficients and partial correlation coefficients between the three performance variables are shown in Figure 19.

We have four samples: GM, FORD, pooling data of GM and FORD, and SIC code 371 industry (Motor Vehicle and Equipment from IRS Reports). We have pointed out that if model 1 is correct then  $p_{13.2}$  should drop to zero, and if model 2 is correct then  $p_{23.1}$  will drop to zero.

We observe that the conditional correlation ( $p_{13.2}$ ) between productivity and profitability does not change very much from their zero-order correlation coefficient ( $p_{13}$ ). This result indicates that productivity directly affects profitability, and thus imports market share is not an intervening variable. Hence, Model 1 is rejected.

For model 2, the results from FORD and pooling data generally confirm the model. For pooling data, the correlation coefficient between



	<u>SI</u>	<u>FORD</u>	<u>POSLI.C</u>	<u>INDUSTRY</u>
P <sub>12</sub>	-0.851	-0.652	-0.683	-0.402
P <sub>23</sub>	-0.834	-0.690	-0.629	-0.895
P <sub>13</sub>	-0.938	0.252	0.540	0.623
P <sub>13.2</sub>	0.979	0.732	+0.898	0.811
P <sub>23.1</sub>	0.612	-0.248	0.030	-0.936

Variable 1: Value added  
Payroll

Variable 2: Market share imports

Variable 3: Operating income  
Sales

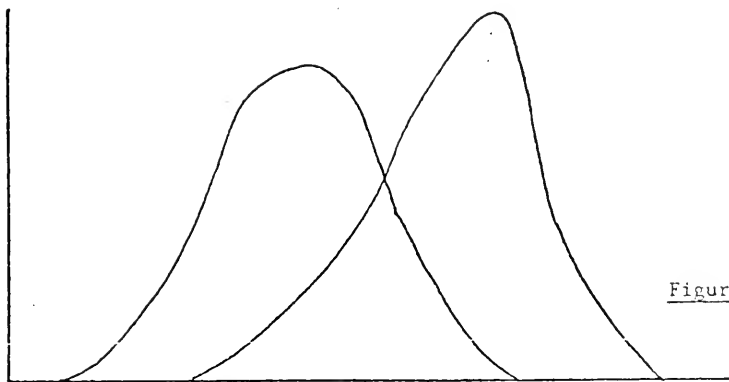
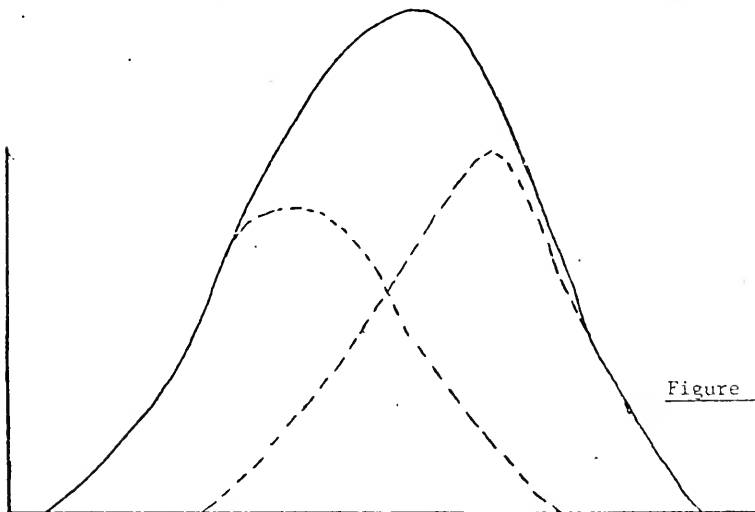
Figure 19



profitability and imports market share was  $-0.629$  originally. After taking away the effect of productivity, the conditional correlation coefficient drops to  $0.03$ . This result indicates that imported cars market share is no longer related to profitability if productivity does not change. A similar result is found for FORD, in that correlation is weakened after controlling for productivity, (from  $-0.690$  to  $0.348$ ). However,  $p_{23.1}$  for GM and the industry 371 are very strange. We observe that  $p_{23.1}$  for GM is "positive" which means that imports market share is positively related to GM's profitability if GM's productivity does not change. This result may be tentatively explained by accepting the hypothesis that imported cars eroded the market position of GM's domestic competitors which resulted in increased profitability for General Motors and foreign cars at the expense of Ford.

We tend to accept the result of pooling data because GM and FORD are different in productivity and thus neither of them represents the universe. However, by pooling them together, the sample may represent the universe very well. For example, suppose the distributions of two samples are shown in Figure 20(a) after pooling the data, the distribution would be a normal distribution as shown in Figure 20(b) which represents the true distribution of the population.



Figure 20(a)Figure 20(b)





## V. CONCLUSIONS

We have observed that our productivity measure for both GM and FORD has declined. However, we should stress again that, although our productivity measure correlates well with managerial performance indicators it is a single factor productivity measure. For instance, if labor replaces capital, the decline of labor productivity may increase capital productivity which may offset the decline of labor productivity.

Ideally, only total factor productivity shows the overall efficiency of the conversion of input to output. Some researchers (Jorgenson, Frienderlander) have used the production function approach to calculate total factor productivity growth. However, these studies are not free of impurities in calculating capital input and total output; they also assume competitive factor markets. These conditions make the calculation of total factor productivity impractical. Although we have also used an impure measure of capital input, as an alternative approach we have analyzed the change of the components of value added to identify various hypotheses concerning the overall efficiency of the U.S. Automobile industry as reflected in the performance of General Motors and Ford.

Two hypotheses may explain the growth of the share of payroll and benefits (labor input) in the value added. The first hypothesis assumes a competitive labor market and the growth of payroll and benefits percentage reflects the efficiency of resource utilization. The second story assumes a non-competitive labor market and the growth of payroll and benefits percentage would not imply improvement in efficiency.



### A. Competitive Labor Market

In a competitive factor market, the only reason explaining why labor input increases faster than capital input is that the marginal product value per dollar of payroll and benefits is greater than marginal product value per dollar of capital. Under these circumstances, the firm prefers to use labor to substitute for capital and the share of payroll and benefits increases.

As labor substitutes capital, capital input decreases and thus the percentage contribution of depreciation in value added decreases. However, we do not know whether the percentage contribution of profits to value added would increase or decrease. This depends on whether the decrease in the share of depreciation can offset the increase in the share of payroll and benefits. If this is the case, the firm is moving toward cost minimization by rational input factor substitution and is improving its efficiency.

The real wage rate (wage rate adjusted by the consumer price index) has grown 2.64% per year for GM and 3.34% for Ford. If the marginal product value of capital increases, due to process innovations or low capital cost, the physical labor productivity should grow even faster. One may argue that if the workers in both firms were so productive, the industry would not be in today's difficulties. However, there is always the possibility that labor has been very productive while at the same time the industry is in trouble. That is because the firm made wrong strategic decisions (e.g. low new investment rate for the production of small cars), which resulted in the decline of profits due to foreign competition. In this case, the problem is industry effectiveness not efficiency.



## B. Non-Competitive Labor Market

The second explanation of the phenomena observed is that the labor market is not competitive. The labor union (UAW) had monopoly power over the firms and was able to increase wages faster than the growth of physical productivity.

In a non-competitive product market, the firm can pass on labor cost increases to consumers. However, in a competitive product market, the firm cannot increase prices accordingly and the increase in labor cost reduces profits. Therefore, under such circumstances, we would observe that the percentage contribution of payroll and benefits to value added increases and that of profits decreases.

The question, why the percentage contribution of payroll and benefits had not increased before 1963, may be satisfactorily answered. The product market was not competitive before 1963 and firms were able to pass on their cost increases to consumers. One piece of evidence supporting the competitiveness of the market is the market share of imports, which has consistently increased since 1963, as shown in Figure 17. Due to competition, the ratio of new car price index to producer price index was greater than one before 1963, but not after 1963 as shown in Figure 18.

If this were the case, then, the management had several alternatives in coping with this problem. First, firms might increase their purchases of materials and services, because it was cheaper to buy from an outside competitive market than to produce themselves. Second, firms might increase their foreign operations and then import cars from their foreign subsidiaries. Third, firms might reduce labor input and increase capital input, if they are substitutable.



Our data confirm that both GM and Ford have gradually reduced their degree of vertical integration, as shown in Figure 1(a,b,c,d). We observe that value added over sales has declined since 1963 for GM and 1960 for Ford. The percentage of foreign operations in total sales for both companies are shown in Figure 21 for Ford; we have not found similar information of GM. We observe that the share of foreign operations increases. This phenomenon can be attributed to importing assembled automobiles, outsourcing of parts and also to increasing demand in foreign countries. We have no data on parts imported by GM and Ford, but we will obtain such data in our further field research.

The time series of gross plant and equipment per employee shown in Figures 22(a) and 23(a) for General Motors and Ford respectively show an increasing pattern. This means that management attempted over time to substitute capital for labor, as economic theory would predict. However, the rate of increase of payroll and benefits was so high that the time series of gross plant and equipment per dollar of payroll and benefits shown in Figures 22(b) and 23(b) have been decreasing since the mid-sixties for both firms.

Hence, not only the market became more competitive in the mid-sixties, but also management did not use capital to substitute for labor fast enough. There are several reasons for that: (i) labor and capital were not substitutable at a faster rate; (ii) high cost fixities prohibited the management from investing in new equipment; (iii) the management had a short term predisposition and (iv) management expected that the union would ask for a higher share in value added were the firm to show more profits.





<u>Imports of Ford</u> <u>as a Percentage of</u> <u>Ford's Domestic Production</u>		<u>Sales of Foreign</u> <u>Operations as a</u> <u>Percentage of Total Sales</u>	
71	2.67%		30%
72	5.08%		31%
73	6.56%		31%
74	5.18%		35%
75	6.11%		40%
76	3.98%		37%
77	5.65%		34%
78	6.08%		35%
79	6.43%		44%
80	10.65%		50%

Figure 21:

Foreign Operations of Ford



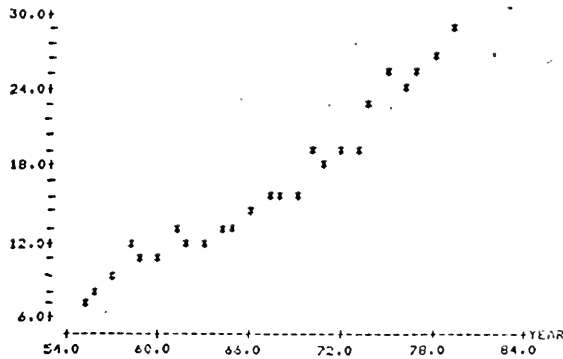


Figure 22(a):

Plant and Equipment per  
Employee (GM)

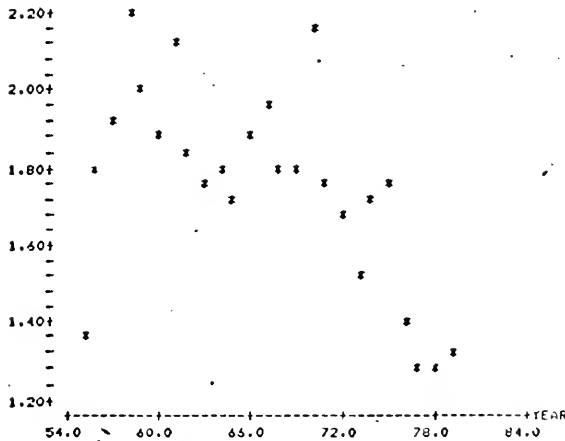


Figure 22(b):

Plant and Equipment over  
Payroll and Benefits (GM)



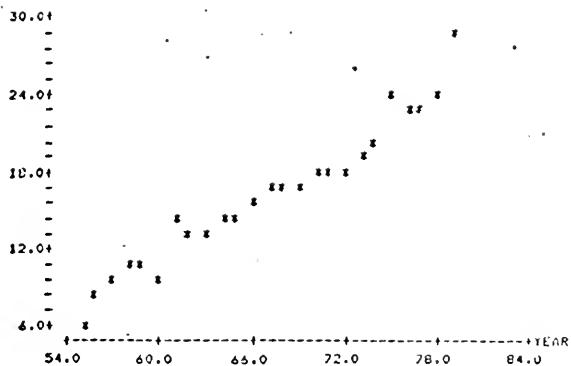


Figure 23(a):

Plant and Equipment per  
Employee (Ford)

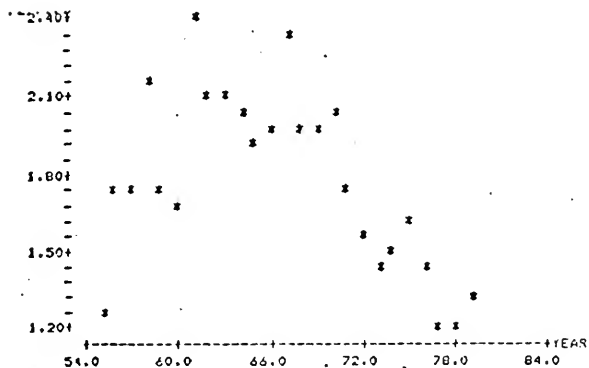


Figure 23(b):

Plant and Equipment over  
Payroll and Benefits (Ford)



High labor fixities, uncertainty and excessive union power seem to be the reasons explaining the decline of productivity and the increase (decrease) of payroll and benefits (profits) in the value added of the U.S. Automobile Industry in the past 25 years.

Although our second hypothesis enjoys stronger data support than our first hypothesis, further research in the causes of productivity change the impact of fixities on innovation will shed more light into this puzzle.





APPENDIX FOR PLOTS

10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100  
101  
102  
103  
104  
105  
106  
107  
108  
109  
110  
111  
112  
113  
114  
115  
116  
117  
118  
119  
120  
121  
122  
123  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133  
134  
135  
136  
137  
138  
139  
140  
141  
142  
143  
144  
145  
146  
147  
148  
149  
150  
151  
152  
153  
154  
155  
156  
157  
158  
159  
160  
161  
162  
163  
164  
165  
166  
167  
168  
169  
170  
171  
172  
173  
174  
175  
176  
177  
178  
179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
270  
271  
272  
273  
274  
275  
276  
277  
278  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
340  
341  
342  
343  
344  
345  
346  
347  
348  
349  
350  
351  
352  
353  
354  
355  
356  
357  
358  
359  
360  
361  
362  
363  
364  
365  
366  
367  
368  
369  
370  
371  
372  
373  
374  
375  
376  
377  
378  
379  
380  
381  
382  
383  
384  
385  
386  
387  
388  
389  
390  
391  
392  
393  
394  
395  
396  
397  
398  
399  
400  
401  
402  
403  
404  
405  
406  
407  
408  
409  
410  
411  
412  
413  
414  
415  
416  
417  
418  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428  
429  
430  
431  
432  
433  
434  
435  
436  
437  
438  
439  
440  
441  
442  
443  
444  
445  
446  
447  
448  
449  
450  
451  
452  
453  
454  
455  
456  
457  
458  
459  
460  
461  
462  
463  
464  
465  
466  
467  
468  
469  
470  
471  
472  
473  
474  
475  
476  
477  
478  
479  
480  
481  
482  
483  
484  
485  
486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538  
539  
540  
541  
542  
543  
544  
545  
546  
547  
548  
549  
550  
551  
552  
553  
554  
555  
556  
557  
558  
559  
560  
561  
562  
563  
564  
565  
566  
567  
568  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
590  
591  
592  
593  
594  
595  
596  
597  
598  
599  
600  
601  
602  
603  
604  
605  
606  
607  
608  
609  
610  
611  
612  
613  
614  
615  
616  
617  
618  
619  
620  
621  
622  
623  
624  
625  
626  
627  
628  
629  
630  
631  
632  
633  
634  
635  
636  
637  
638  
639  
640  
641  
642  
643  
644  
645  
646  
647  
648  
649  
650  
651  
652  
653  
654  
655  
656  
657  
658  
659  
660  
661  
662  
663  
664  
665  
666  
667  
668  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688  
689  
690  
691  
692  
693  
694  
695  
696  
697  
698  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
710  
711  
712  
713  
714  
715  
716  
717  
718  
719  
720  
721  
722  
723  
724  
725  
726  
727  
728  
729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
740  
741  
742  
743  
744  
745  
746  
747  
748  
749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768  
769  
770  
771  
772  
773  
774  
775  
776  
777  
778  
779  
780  
781  
782  
783  
784  
785  
786  
787  
788  
789  
790  
791  
792  
793  
794  
795  
796  
797  
798  
799  
800  
801  
802  
803  
804  
805  
806  
807  
808  
809  
810  
811  
812  
813  
814  
815  
816  
817  
818  
819  
820  
821  
822  
823  
824  
825  
826  
827  
828  
829  
830  
831  
832  
833  
834  
835  
836  
837  
838  
839  
840  
841  
842  
843  
844  
845  
846  
847  
848  
849  
850  
851  
852  
853  
854  
855  
856  
857  
858  
859  
860  
861  
862  
863  
864  
865  
866  
867  
868  
869  
870  
871  
872  
873  
874  
875  
876  
877  
878  
879  
880  
881  
882  
883  
884  
885  
886  
887  
888  
889  
890  
891  
892  
893  
894  
895  
896  
897  
898  
899  
900  
901  
902  
903  
904  
905  
906  
907  
908  
909  
910  
911  
912  
913  
914  
915  
916  
917  
918  
919  
920  
921  
922  
923  
924  
925  
926  
927  
928  
929  
930  
931  
932  
933  
934  
935  
936  
937  
938  
939  
940  
941  
942  
943  
944  
945  
946  
947  
948  
949  
950  
951  
952  
953  
954  
955  
956  
957  
958  
959  
960  
961  
962  
963  
964  
965  
966  
967  
968  
969  
970  
971  
972  
973  
974  
975  
976  
977  
978  
979  
980  
981  
982  
983  
984  
985  
986  
987  
988  
989  
990  
991  
992  
993  
994  
995  
996  
997  
998  
999  
1000

Figure 1(a):

Value Added over  
Sales (GM)

55 0.501228  
56 0.489043  
57 0.490494  
58 0.492306  
59 0.492513  
60 0.500727  
61 0.509780  
62 0.516326  
63 0.520340  
64 0.510266  
65 0.511894  
66 0.504528  
67 0.503784  
68 0.504561  
69 0.480342  
70 0.441058  
71 0.481154  
72 0.475346  
73 0.455450  
74 0.398452  
75 0.412844  
76 0.430770  
77 0.427867  
78 0.422970  
79 0.402167

Figure 1(b):

Value Added over  
Sales (Ford)

55 0.450900  
0.442187  
0.415179  
0.439359  
0.483854  
0.483180  
0.409002  
0.409790  
0.380442  
0.389671  
0.397741  
0.386840  
0.347503  
0.395500  
0.377422  
0.376703  
0.415021  
0.405780  
0.285920  
0.339201  
0.323544  
0.350005  
0.351492  
0.343873  
79 0.325546

Figure 1(c):

Value Added of Cost of  
Goods Sold over Cost of  
Goods Sold (GM)

55 0.301374  
0.321366  
0.331736  
0.369352  
0.307273  
0.341421  
0.350906  
0.323153  
0.325105  
0.309445  
0.324147  
0.345454  
0.350633  
0.348258  
0.302157  
0.314089  
0.325213  
0.310256  
0.284687  
0.266267  
0.314436  
0.278204  
0.279680  
0.283540  
79 0.284277

Figure 1(d):

Value Added of Cost of  
Goods Sold over Cost of  
Goods Sold (Ford)

55 0.249551  
0.302947  
0.263385  
0.364646  
0.301623  
0.321133  
0.215628  
0.219752  
0.192274  
0.207902  
0.221321  
0.218547  
0.245431  
0.252191  
0.231755  
0.239770  
0.267898  
0.252798  
0.103177  
0.222128  
0.215717  
0.218694  
0.218672  
0.219162  
79 0.232055

Figure 2(a):

Value Added over  
Payroll and Benefits  
(GM)

55 2.02033  
1.82269  
1.80484  
1.68685  
1.82446  
1.80945  
1.77252  
1.95062  
1.99817  
1.92859  
1.96235  
1.82960  
1.78667  
1.76135  
1.72817  
1.34846  
1.67843  
1.67290  
1.62301  
1.34057  
1.43599  
1.59039  
1.55906  
1.55845  
79 1.42148

Figure 2(b):

Depreciation over  
Payroll and Benefits  
(GM)

55 0.222324  
0.256295  
0.281641  
0.318796  
0.268634  
0.268125  
0.267328  
0.246380  
0.247519  
0.233741  
0.236262  
0.269959  
0.273135  
0.240029  
0.237536  
0.239433  
0.222146  
0.204942  
0.191424  
0.174414  
0.207702  
0.172307  
0.155067  
0.175720  
79 0.168490

Figure 2(c):

Depreciation over  
Payroll and Benefits  
in Constant Dollars (GM)

55 17.8304  
20.8624  
23.7426  
27.6077  
23.4518  
23.7827  
23.9526  
22.3220  
22.7002  
21.7145  
22.3267  
26.2400  
27.3135  
25.0110  
26.0815  
27.8460  
26.9464  
25.6792  
25.4785  
25.7609  
33.4816  
29.3783  
29.1446  
34.3357  
79 36.6298

Figure 2(d):

Capital Expenditures  
(Current Year) over Pay  
and Benefits (GM)

55 0.191685  
0.303418  
0.158479  
0.099402  
0.102544  
0.149085  
0.153649  
0.163602  
0.148264  
0.200060  
0.240147  
0.211704  
0.160587  
0.130497  
0.149578  
0.181188  
0.125344  
0.107828  
0.112260  
0.149188  
0.119562  
0.076969  
0.121876  
0.158415  
79 0.178244



Figure 2(e):

Capital Expenditures  
(One Year Lag) over  
Payroll and Benefits  
(GM)

56 0.280702  
0.161471  
0.090091  
0.118072  
0.168557  
0.142622  
0.196977  
0.164135  
0.212757  
0.284681  
0.215675  
0.162627  
0.151366  
0.158351  
0.162532  
0.161666  
0.116612  
0.133454  
0.140726  
0.122847  
0.099450  
0.144159  
0.178349  
79 0.195136

Figure 2(f):

Capital Expenditures  
(One Year Lead) over  
Payroll and Benefits  
(GM)

56 0.207196  
0.297796  
0.174858  
0.086330  
0.090698  
0.160611  
0.127615  
0.147782  
0.139285  
0.168764  
0.235726  
0.209048  
0.138447  
0.123268  
0.166746  
0.140704  
0.116087  
0.090704  
0.119011  
0.145198  
0.092534  
0.065072  
0.108275  
79 0.144729

Figure 2(g):

Operating Profits  
over Payroll and  
Benefits (GM)

55 0.798008  
0.566391  
0.523192  
0.368054  
0.555822  
0.541324  
0.505191  
0.704243  
0.750618  
0.694852  
0.726086  
0.559644  
0.513530  
0.521322  
0.490635  
0.109029  
0.456284  
0.467961  
0.431587  
0.166159  
0.228291  
0.418084  
0.403992  
0.382726  
79 0.252987

Figure 3(a):

Value Added over Payroll  
and Benefits (Ford)

55 1.83351  
1.52170  
1.62134  
1.42015  
1.76223  
1.61266  
1.75376  
1.77444  
1.63696  
1.66167  
1.69460  
1.63037  
1.29957  
1.58132  
1.52329  
1.48302  
1.57374  
1.57281  
1.11061  
1.31498  
1.30638  
1.42947  
1.48569  
1.42930  
79 1.29522

Figure 3(b):

Depreciation over  
Payroll and Benefits  
(Ford)

56 0.169038  
0.192158  
0.259129  
0.331579  
0.242952  
0.195674  
0.250111  
0.210160  
0.204638  
0.204142  
0.196318  
0.211466  
0.239827  
0.210862  
0.216141  
0.213165  
0.189342  
0.172921  
0.153789  
0.147103  
0.168282  
0.141567  
0.122661  
0.125237  
79 0.145811

Figure 3(c):

Depreciation over  
Payroll and Benefits  
in Constant Dollars  
(Ford)

56 13.4767  
15.6417  
21.7603  
28.7147  
21.2097  
17.3563  
22.4099  
19.0405  
18.7653  
18.9648  
18.5521  
20.5545  
23.9827  
21.9718  
23.7323  
24.7911  
22.9672  
21.6670  
20.4693  
21.7272  
27.1271  
24.1372  
22.2630  
24.4713  
79 31.6993

Figure 3(d):

Capital Expenditures  
(Current Year) over  
Payroll and Benefits  
(Ford)

56 0.180981  
0.409208  
0.277332  
0.139309  
0.096414  
0.146120  
0.169234  
0.147597  
0.170823  
0.198152  
0.227071  
0.232297  
0.234541  
0.130316  
0.143476  
0.145889  
0.139960  
0.140488  
0.144625  
0.132608  
0.101422  
0.074422  
0.119420  
0.149814  
79 0.195605

Figure 3(e):

Capital Expenditures  
(One Year Lag) over  
Payroll and Benefits  
(Ford)

55 0.391995  
0.304354  
0.113341  
0.117845  
0.151545  
0.169847  
0.177317  
0.185736  
0.224675  
0.269180  
0.249955  
0.221764  
0.164047  
0.150354  
0.151571  
0.157590  
0.170583  
0.168831  
0.135023  
0.097835  
0.090986  
0.150749  
0.172664  
79 0.205182



Figure 3(f):

Capital Expenditures  
(One Year Lead) over  
Payroll and Benefits  
(Ford)

56	0.189927
	0.372876
	0.340872
	0.113974
	0.091158
	0.145592
	0.140845
	0.135746
	0.150657
	0.167154
	0.211029
	0.245681
	0.186315
	0.124355
	0.138078
	0.129567
	0.115260
	0.126345
	0.142080
	0.137469
	0.085187
	0.060539
	0.103616
	0.142821

Figure 3(g):

Operating Profits  
over Payroll and  
Benefits (Ford)

55	0.665471
	0.329540
	0.363214
	0.088569
	0.519276
	0.416984
	0.503644
	0.564277
	0.432321
	0.457533
	0.498286
	0.418905
	0.059744
	0.370459
	0.307148
	0.269854
	0.304395
	0.379886
	-0.043175
	0.167874
	0.138097
	0.287905
	0.363028
	0.304060
79	0.149410

Figure 6(a):

Payroll and Benefits  
over Value Added (GM)

55	0.494768
	0.548641
	0.554067
	0.592821
	0.548109
	0.552654
	0.564169
	0.512657
	0.500459
	0.518513
	0.509594
	0.546567
	0.559702
	0.567746
	0.578646
	0.741586
	0.595795
	0.597763
	0.616139
	0.745950
	0.696382
	0.628776
	0.641413
	0.641665
79	0.703493

Figure 6(b):

Depreciation over Value  
Added (GM)

55	0.110043
	0.140614
	0.156050
	0.188789
	0.147241
	0.148181
	0.150818
	0.126308
	0.123898
	0.121198
	0.120397
	0.147550
	0.152874
	0.136276
	0.137450
	0.177560
	0.132354
	0.122507
	0.117944
	0.130104
	0.144640
	0.108343
	0.099462
	0.112753
79	0.118532

Figure 6(c):

Depreciation over  
Value Added in  
Constant Dollars (GM)

55	0.394788
	0.310745
	0.289883
	0.218190
	0.304651
	0.299165
	0.285013
	0.361035
	0.375653
	0.360290
	0.370009
	0.305883
	0.287424
	0.295977
	0.293904
	0.080854
	0.271851
	0.279730
	0.265917
	0.123946
	0.158979
	0.262881
	0.259125
	0.245582
79	0.177975

Figure 7(a):

Payroll and Benefits  
over Value Added  
(Ford)

55	0.545402
	0.657161
	0.616772
	0.704152
	0.567463
	0.620094
	0.570205
	0.563559
	0.610889
	0.601802
	0.590109
	0.613357
	0.769485
	0.632383
	0.656474
	0.674300
	0.635430
	0.635806
	0.900403
	0.760469
	0.765475
	0.699558
	0.673088
	0.699644
79	0.772069

Figure 7(b):

Depreciation over  
Value Added  
(Ford)

55	0.091648
	0.126279
	0.159207
	0.233482
	0.137867
	0.121336
	0.142614
	0.118437
	0.125011
	0.122853
	0.115849
	0.129704
	0.194543
	0.133345
	0.141891
	0.143737
	0.120314
	0.109944
	0.138472
	0.111368
	0.128916
	0.099035
	0.082562
	0.087621
79	0.112574

Figure 7(c):

Depreciation over  
Value Added in  
Constant Dollars (Ford)

55	0.362949
	0.216560
	0.224020
	0.062366
	0.294670
	0.258569
	0.287180
	0.318003
	0.264100
	0.275344
	0.294042
	0.256939
	0.045972
	0.234272
	0.201635
	0.181962
	0.244256
	0.254250
	-0.038875
	0.127663
	0.105710
	0.201407
	0.244350
	0.212734
79	0.115355





Figure 6(d):

Capital Expenditures  
(Current Year) over  
Value Added (GM)

55	0.094078
	0.164467
	0.097808
	0.053928
	0.056205
	0.082392
	0.083684
	0.083872
	0.074200
	0.103734
	0.122377
	0.115711
	0.089881
	0.074089
	0.086553
	0.134366
	0.074799
	0.064456
	0.069168
	0.111287
	0.083261
	0.048396
	0.078173
79	0.101668
	0.125393

Figure 6(e):

Capital Expenditures  
(One Year Lag) over  
Value Added (GM)

56	0.138939
	0.089589
	0.049917
	0.069996
	0.092388
	0.078821
	0.111128
	0.084145
	0.106576
	0.147611
	0.109906
	0.088997
	0.084720
	0.089903
	0.094049
	0.119890
	0.069477
	0.079774
	0.086707
	0.091637
	0.069256
	0.090644
	0.114395
79	0.125212

Figure 6(f):

Capital Expenditures  
(One Year Lead) over  
Value Added (GM)

56	0.113676
	0.164999
	0.103659
	0.047310
	0.050125
	0.090612
	0.065423
	0.073959
	0.072221
	0.083001
	0.128840
	0.117005
	0.078603
	0.071328
	0.123657
	0.083831
	0.069393
	0.055886
	0.088776
	0.101113
	0.058193
	0.041738
	0.069476
79	0.101816

Figure 6(g):

Operating Profits over  
Value Added (GM)

55	0.394988
	0.310745
	0.289883
	0.218190
	0.304651
	0.299165
	0.285013
	0.361035
	0.375653
	0.360290
	0.370009
	0.305883
	0.287424
	0.295979
	0.283904
	0.080854
	0.271851
	0.272730
	0.265917
	0.123946
	0.158978
	0.262881
	0.259125
79	0.245582
	0.177975

Figure 7(d):

Capital Expenditures  
(Current Year) over  
Value Added (Ford)

55	0.098707
	0.268915
	0.171051
	0.098095
	0.054711
	0.090608
	0.096498
	0.093180
	0.104354
	0.119248
	0.133996
	0.142481
	0.180476
	0.082410
	0.094189
	0.098373
	0.088935
	0.088323
	0.130221
	0.100844
	0.077636
	0.053461
	0.080380
	0.104816
79	0.151021

Figure 7(e):

Capital Expenditures  
(One Year Lag) over  
Value Added (Ford)

56	0.213795
	0.200010
	0.069906
	0.082981
	0.087699
	0.105321
	0.101124
	0.104673
	0.137251
	0.161993
	0.147500
	0.136020
	0.126232
	0.095081
	0.099502
	0.106263
	0.108393
	0.107344
	0.121575
	0.074401
	0.069647
	0.105458
	0.116218
79	0.143555

Figure 7(f):

Capital Expenditures  
(One Year Lead) over  
Value Added (Ford)

56	0.124156
	0.229979
	0.240025
	0.064676
	0.056526
	0.083017
	0.079375
	0.082926
	0.090666
	0.098639
	0.129436
	0.189048
	0.117822
	0.081636
	0.093119
	0.082332
	0.073288
	0.108359
	0.108015
	0.105229
	0.059593
	0.040748
	0.072494
79	0.110268

Figure 7(g):

Operating Profits over  
Value Added (Ford)

55	0.362949
	0.216560
	0.224020
	0.062366
	0.294670
	0.258569
	0.287180
	0.318003
	0.264100
	0.275344
	0.294042
	0.256939
	0.045972
	0.234272
	0.201635
	0.181962
	0.244256
	0.254250
	-0.038875
	0.127663
	0.105710
	0.201407
	0.244350
	0.212731
79	0.115355



Figure 12(a):

Value Added "Elasticity" of Payroll and Benefits (GM)

0.4527  
2.1214  
0.6125  
0.6172  
1.0767  
0.7911  
0.6277  
0.7987  
2.3526  
0.8994  
-0.3739  
-1.1487  
1.1145  
1.5152  
0.3431  
0.4773  
1.0457  
1.2312  
0.2568  
0.2731  
0.6777  
1.1461  
1.0035  
79 -65.6095

Figure 12(b):

Value Added "Elasticity" of Depreciation (GM)

56 -0.4021  
13.4466  
-0.1693  
-0.1212  
1.0590  
0.8216  
0.3374  
0.8379  
0.1858  
0.9614  
-3.2706  
-2.2261  
0.1347  
1.2312  
0.3193  
0.3231  
-0.0294  
0.7198  
0.6363  
2.2222  
0.1668  
0.4042  
2.2012  
79 -34.4283

Figure 12(c):

Value Added "Elasticity" of Operating Profits (GM)

56 2.076  
-6.612  
2.370  
3.011  
0.934  
1.474  
2.087  
1.343  
-0.533  
1.158  
4.292  
6.396  
1.237  
-0.095  
2.668  
7.281  
1.401  
0.629  
2.883  
4.092  
3.170  
0.896  
0.530  
79 191.306

Figure 13(a):

Value Added "Elasticity" of Payroll and Benefits (Ford)

56 0.2052  
0.5755  
0.6487  
0.4302  
-1.7957  
0.0397  
0.9343  
28.5108  
0.8866  
0.9876  
2.1577  
0.2212  
0.4868  
5.0561  
3.3934  
0.6465  
1.0034  
-0.9527  
0.0886  
0.8486  
0.6295  
0.8409  
1.4022  
79 -0.9904

Figure 13(b):

Value Added "Elasticity" of Depreciation (Ford)

56 -0.4656  
2.8010  
-0.1569  
-0.2021  
4.6142  
3.0932  
0.0446  
19.1813  
0.8684  
0.6701  
4.5143  
-0.2937  
0.2009  
7.6236  
2.1468  
0.0006  
0.5101  
-0.2175  
-0.1267  
-2.4843  
0.0052  
0.3005  
1.6247  
79 -4.4761

Figure 13(c):

Value Added "Elasticity" of Operating Profits (Ford)

56 2.5644  
1.2379  
2.7895  
11.9337  
4.6930  
2.3208  
1.6048  
-54.5255  
1.3246  
1.3929  
-2.7080  
3.5123  
12.7986  
-13.8329  
-7.5994  
3.0994  
1.2326  
6.4097  
-24.1228  
4.9549  
4.8954  
1.8966  
-0.3189  
79 9.8016

Figure 14(a):

Operating Return to Sales (GM)

55 20.5600  
15.9700  
14.7600  
11.3800  
15.6900  
15.7200  
15.2500  
19.3400  
20.2200  
19.0400  
19.5600  
15.9900  
15.0200  
15.4100  
14.0400  
3.4700  
13.2500  
13.6300  
12.2000  
4.8200  
6.6700  
11.4400  
11.2200  
10.5200

Figure 14(b):

Operating Return to Equity (GM)

55 60.1100  
37.6400  
33.0600  
21.6100  
32.8100  
34.4300  
28.8600  
42.6000  
46.8300  
42.5700  
35.3200  
37.0500  
32.4600  
35.9400  
33.3600  
6.6000  
34.6400  
35.5300  
34.7400  
12.1400  
18.2000  
37.6600  
39.1300  
37.9200



Figure 12(a):

Value Added "Elasticity" of Payroll and Benefits (GM)

56 0.4527  
2.1214  
0.6125  
0.6172  
1.0767  
0.7911  
0.6277  
0.7987  
2.3526  
0.8994  
-0.3739  
-1.1487  
1.1145  
1.5152  
0.3431  
0.4773  
1.0457  
1.2312  
0.2568  
0.2731  
0.6777  
1.14.1  
1.0635  
79 -65.6095

Figure 12(b):

Value Added "Elasticity" of Depreciation (GM)

56 -0.4021  
13.4466  
-0.1693  
-0.1212  
1.0590  
0.8216  
0.3374  
0.8379  
0.1858  
0.9614  
-3.2706  
-2.2261  
0.1347  
1.2312  
0.3193  
0.3231  
-0.0294  
0.7198  
0.6363  
2.2222  
0.1668  
0.4042  
2.2012  
79 -34.4283

Figure 12(c):

Value Added "Elasticity" of Operating Profits (GM)

56 2.076  
-6.612  
2.370  
3.011  
0.834  
1.474  
2.087  
1.343  
-0.533  
1.158  
4.282  
6.396  
1.237  
-0.095  
2.668  
7.281  
1.401  
0.629  
2.883  
4.092  
3.170  
0.896  
0.530  
79 191.306

Figure 13(a):

Value Added "Elasticity" of Payroll and Benefits (Ford)

56 0.2052  
0.5755  
0.6487  
0.4302  
-1.7957  
0.0397  
0.9343  
28.5108  
0.8866  
0.8876  
2.1577  
0.2212  
0.4868  
5.0561  
3.3934  
0.6465  
1.0034  
-0.9527  
0.0886  
0.8486  
0.6295  
0.8409  
1.4022  
79 -0.9904

Figure 13(b):

Value Added "Elasticity" of Depreciation (Ford)

56 -0.4656  
2.8010  
-0.1569  
-0.2021  
4.6142  
3.0932  
0.0446  
19.1813  
0.8684  
0.6701  
4.5143  
-0.2937  
0.2009  
7.8236  
2.1468  
0.0006  
0.5101  
-0.2175  
-0.1267  
-2.4843  
0.0052  
0.3005  
1.6247  
79 -4.4761

Figure 13(c):

Value Added "Elasticity" of Operating Profits (Ford)

56 2.5644  
1.2379  
2.7895  
11.9337  
4.6930  
2.3208  
1.6048  
-54.5255  
1.3246  
1.3929  
-2.7080  
3.5123  
12.7986  
-13.8329  
-7.5994  
3.0994  
1.2326  
6.4097  
-24.1228  
4.9549  
4.8954  
1.8966  
-0.3189  
79 9.8016

Figure 14(a):

Operating Return to Sales (GM)

55 20.5600  
15.9700  
14.7600  
11.3800  
15.6800  
15.7200  
15.2500  
19.3400  
20.2200  
19.0400  
19.5600  
15.9900  
15.0200  
15.4100  
14.0400  
3.4700  
13.2500  
13.6300  
12.2000  
4.8200  
6.6700  
11.4400  
11.2200  
10.5200

Figure 14(b):

Operating Return to Equity (GM)

55 60.1100  
37.6400  
33.0600  
21.6100  
32.8100  
34.4300  
28.8600  
42.6000  
46.8300  
42.5700  
35.3200  
37.0500  
32.4600  
35.9400  
33.3600  
6.6000  
34.6400  
35.5300  
34.7400  
12.1400  
18.2000  
37.6600  
39.1300  
37.9200



Figure 14(c):		Figure 14(d):		Figure 14(e):		Figure 14(f):	
Operating Return to Plant and Equipment (GM)		Operating Return on Assets (GM)		Net Return on Sales (GM)		Net Return on Plant and Equipment (GM)	
55	108.730	55	40.3000	55	9.5600	55	50.5500
	58.090		26.2400		7.8500		28.5500
	52.000		23.7600		7.6800		27.0500
	36.530		15.7200		6.6500		21.3500
	62.090		24.3100		7.7700		30.7700
	66.500		25.5400		7.5300		31.8500
	57.340		21.0000		7.8300		29.4400
	98.250		30.8800		9.9600		50.6000
	110.200		34.6000		9.6500		52.5900
	94.440		31.4100	10.2100		50.6400	
	97.410		35.3200	10.2500		51.0500	
	69.560		26.4600	8.8700		38.5800	
	62.630		22.6600	8.1300		33.9000	
	71.660		25.0200	7.6100		35.3900	
	66.410		23.0000	7.0400		33.3000	
	12.010		4.5600	3.2500		11.2500	
	67.970		20.5300	6.8500		35.1400	
	75.780		22.7000	7.1000		39.4800	
	76.980		21.5000	6.7000		42.2800	
	24.490		7.4300	3.0100		15.2900	
	37.150		11.0500	3.5100		19.5500	
	85.570		22.0800	6.1300		45.8500	
	85.830		23.1000	6.0700		46.4400	
	77.220		21.7300	5.5400		40.6600	
79	45.390	79	14.9000	79	4.3600	79	27.3400

Figure 14(g):		Figure 14(h):		Figure 14(i):		Figure 14(j):	
Net Return on Equity (GM)		Net Return on Assets (GM)		Operating Income (GM)		Net Income (GM)	
55	27.9500	55	18.7500	55	2558.40	55	1189.50
	18.5000		12.9000		1724.00		847.40
	17.2000		12.3600		1622.40		843.60
	12.6300		9.2000		1083.50		633.60
	16.2600		12.0500		1761.40		873.10
	16.4900		12.2400		2000.60		959.00
	14.8200		10.7900		1737.80		892.80
	21.9400		15.9100		2831.90		1459.10
	22.3500		16.5100		3335.50		1591.80
	22.8300		16.8500		3236.50		1734.80
	18.5100		13.4700		4055.80		2125.60
	20.5500		14.6800		3230.30		1793.40
	17.5700		12.2600		3007.00		1627.30
	17.7500		12.3600		3505.60		1731.90
	16.7300		11.5400		3411.00		1710.70
	6.1800		4.3000		651.00		609.10
	17.9100		10.6100		3745.60		1935.70
	18.5100		11.8400		4149.20		2162.80
	19.0800		11.8200		4372.30		2398.10
	7.5800		4.6400		1516.30		950.00
	9.5800		5.8100		2383.20		1253.10
	20.1800		11.8800		5398.40		2902.80
	21.1700		12.5200		6155.70		3337.50
	19.9700		11.4600		6653.30		3508.00
79	15.0800	79	8.9800	79	4799.70	79	2892.70





Figure 14(k):

Net Income in  
Constant Dollars  
(GM)

55 1483.17  
1041.03  
1000.71  
731.64  
1000.11  
1081.17  
996.43  
1610.49  
1735.88  
1867.38  
2249.31  
1845.06  
1627.30  
1662.09  
1550.01  
523.73  
1578.00  
1726.10  
1801.73  
643.20  
777.36  
1702.52  
1838.84  
1795.29  
1330.59

Figure 15(a):

Operating Return  
to Sales (Ford)

55 16.6100  
9.5200  
9.2400  
8.1000  
14.2200  
12.4800  
12.2000  
12.4500  
11.7600  
10.1900  
11.1200  
9.4600  
1.4200  
9.0800  
7.5200  
6.7700  
7.7100  
8.0100  
6.8200  
2.5700  
1.8200  
5.5000  
7.2600  
5.5200  
2.1100

Figure 15(b):

Operating Return  
to Equity (Ford)

55 46.5500  
20.8100  
23.1900  
14.4700  
29.1100  
22.7000  
26.1800  
29.4700  
27.6400  
24.5700  
28.5800  
24.2200  
3.2500  
25.8500  
21.2800  
18.5600  
22.8200  
27.1200  
24.4900  
10.6900  
6.8500  
22.1800  
32.4900  
24.3400  
8.8000

Figure 15(c):

Operating Return  
to Plant and Equipment  
(Ford)

55 77.9300  
26.2500  
28.9500  
20.0100  
49.6300  
43.1800  
39.0400  
47.0600  
45.0400  
38.1100  
42.4800  
33.6800  
3.8900  
32.2300  
27.0000  
23.4200  
28.0600  
34.1200  
30.2300  
10.6800  
7.8400  
28.4300  
44.2600  
31.8500  
9.9500

Figure 15(d):

Operating Return  
on Assets (Ford)

55 34.2500  
15.0900  
16.3300  
10.6900  
22.0400  
8.9800  
15.9800  
18.5500  
17.2900  
15.2900  
16.9000  
14.2800  
1.8700  
14.2600  
12.0300  
10.2200  
12.0300  
13.9400  
12.1200  
4.2800  
3.2900  
10.0600  
14.2800  
10.6900  
3.9000

Figure 15(e):

Net Return on  
Sales (Ford)

55 8.12000  
5.34000  
5.09000  
2.81000  
8.43000  
8.17000  
6.10000  
5.94000  
5.59000  
5.23000  
6.09000  
5.07000  
0.80000  
4.45000  
3.70000  
3.44000  
4.00000  
4.31000  
3.94000  
1.39000  
1.35000  
3.40000  
4.42000  
3.72000  
2.69000

Figure 15(f):

Net Return on  
Plant and Equip-  
ment (Ford)

55 38.0900  
14.7200  
15.9600  
6.9400  
29.4200  
28.2700  
19.5200  
22.4500  
21.4100  
19.5600  
23.2600  
18.0500  
2.1900  
15.8000  
13.2800  
11.9000  
14.5600  
18.3600  
17.4500  
5.7800  
5.8200  
17.5800  
26.9400  
21.4600  
12.6900

Figure 15(g):

Net Return on Equity  
(Ford)

55 22.7500  
11.6700  
12.7800  
5.0200  
17.2600  
14.8600  
13.0900  
14.0600  
13.1400  
12.6100  
15.6500  
12.9800  
1.8300  
12.6700  
10.4700  
9.4300  
11.8400  
14.5900  
14.1500  
5.7800  
5.0800  
13.7100  
19.7800  
16.4000  
11.2200



Figure 15(h):

Net Return on  
Assets (Ford)

55	16.7400
	8.4600
	9.0000
	3.7100
	13.0400
	11.3900
	8.0000
	8.8700
	8.1200
	7.8300
	9.2500
	7.6800
	1.0600
	7.0000
	5.9400
	5.2100
	6.2500
	7.4800
	7.0000
	2.5500
	2.3000
	6.2300
	8.6900
	7.1900
79	4.9700

Figure 15(i):

Operating  
Income (Ford)

55	929.30
	442.60
	533.40
	128.20
	761.50
	653.80
	818.40
	1007.10
	1028.20
	985.80
	1282.50
	1157.50
	171.90
	1278.90
	1110.00
	1014.80
	1267.40
	1617.90
	1553.80
	605.20
	436.40
	1586.90
	2745.60
	2358.50
79	917.00

Figure 15(j):

Net Income  
(Ford)

55	454.10
	248.20
	294.00
	116.20
	451.40
	427.90
	409.60
	480.70
	488.50
	505.60
	703.10
	621.00
	84.10
	626.60
	546.50
	515.70
	656.70
	870.00
	906.50
	327.10
	322.70
	983.10
	1672.80
	1588.90
79	1169.30

Figure 15(k):

Net Income in Constant  
Dollars (Ford)

55	566.209
	304.914
	348.754
	134.180
	517.068
	482.412
	457.143
	530.574
	532.715
	544.241
	744.021
	638.889
	84.100
	601.344
	497.723
	443.422
	541.385
	694.333
	681.067
	221.462
	200.186
	576.598
	921.653
	813.152
79	537.856

Figure 17:

Imported Cars  
Market Share

58	9.1900
	10.6800
	6.2400
	4.8100
	5.1400
	5.0800
	6.2400
	6.1000
	9.0100
	7.2000
	10.7000
	11.7000
	15.3000
	15.3000
	14.8000
	15.4000
	15.9000
	18.4000
	14.8000
	18.6000
	17.7000
79	21.8000

Figure 18:

New Car Price  
Index over  
Producer Price  
Index (Automobile  
Industry)

55	1.05330
	1.02522
	1.03470
	1.03466
	1.05583
	1.05769
	1.05984
	1.05578
	1.05828
	1.04985
	1.02437
	1.00507
	1.00000
	1.00000
	0.99618
	0.98938
	0.97476
	0.94068
	0.93205
	0.90944
	0.88243
	0.88231
	0.87294
	0.87386
79	0.87138

Figure 22(a):

Plant and Equipment  
per Employee (GM)

55	6.9782
	8.7981
	9.8016
	11.4302
	11.1012
	11.2025
	12.6669
	11.8852
	11.9633
	12.6994
	12.9683
	14.1224
	15.4274
	15.6923
	15.9972
	19.4625
	18.4174
	19.4654
	19.2575
	22.9030
	25.7028
	24.3210
	24.9196
	26.7837
79	29.1669

Figure 22(b):

Plant and Equipment over  
Payroll and Benefits (C)

55	1.37259
	1.79625
	1.92800
	2.19689
	1.98218
	1.88952
	2.13887
	1.82268
	1.75426
	1.80655
	1.72948
	1.87590
	1.97684
	1.80260
	1.81996
	2.16395
	1.76682
	1.69589
	1.50683
	1.71943
	1.74266
	1.40176
	1.29380
	1.27622
79	1.31520



Figure 23(a):

Figure 23(b):

Plant and Equipment per Employee (Ford)		Plant and Equipment over Payroll and Benefits (Ford)	
55	6.5208	55	1.23380
	8.7665		1.71481
	9.4601		1.75519
	11.3085		2.13709
	10.2346		1.73182
	10.0692		1.70382
	14.2892		2.37384
	13.1210		2.09442
	13.4829		2.07098
	14.0469		2.02430
	14.5926		1.91987
	15.2611		1.98628
	16.7225		2.33927
	16.6942		1.95251
	16.5403		1.97641
	18.1913		2.03282
	17.6841		1.76036
	18.5544		1.55487
	18.6310		1.43323
	20.3925		1.50949
	23.0123		1.63614
	23.0861		1.42135
	23.1930		1.22138
	24.5674		1.18634
79	28.8401	79	1.29637



MIT LIBRARIES



3 9080 004 493 281







Date Due

Lib-26-67



